

APPLICATION BY	§	BEFORE THE
URANIUM ENERGY CORP	§	
	§	TEXAS COMMISSION ON
FOR TCEQ PRODUCTION AREA	§	
AUTHORIZATION NO.	§	ENVIRONMENTAL QUALITY
UR03075PAA1	§	

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**EXECUTIVE DIRECTOR'S RESPONSE TO PUBLIC COMMENT**

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The Executive Director of the Texas Commission on Environmental Quality (the commission or TCEQ) files this Response to Public Comment (Response) on the Production Area Authorization (PAA) application by Uranium Energy Corp (UEC) for PAA No. UR03075PAA1 (PAA1) and the Executive Director's preliminary decision on the application.

As required by Title 30, Texas Administrative Code (TAC), Section (§) 55.156, before an application is approved, the Executive Director (ED) prepares a response to all timely, relevant and material, or significant comments, whether or not withdrawn. The Office of Chief Clerk timely received comment letters and oral comments at a public meeting held on October 5, 2009 in Goliad, Texas.

The following people submitted written comments and/or made formal oral comments at the public meeting:

Goliad County Groundwater  
 Conservation District  
 Sierra Club, Coastal Bend Group  
 Blackburn Carter  
 Albrecht, Kathy  
 Albrecht, Ray  
 Allen-Lampley, Barbara  
 Anklaam, Mary  
 Anklaam, Thomas  
 Arnold, Karon  
 Arnold, Raymond  
 Bettge, Catherine  
 Bettge, Richard  
 Blanton, Gary Mr.  
 Blanton, Mrs.  
 Brown, Gene

Brown, Reta  
 Brysch, Brenda  
 Brysch, Larrie  
 Buelter, Kenneth  
 Burrows, Roland  
 Caldwell, John  
 Caldwell, Pearl  
 Calhoun, Powell  
 Carter, Raymond  
 Cook, Ginger  
 Cook, Lynn  
 Diaz Black, Monica  
 Duke, John  
 Duke, Wanda  
 Fabian, Joan  
 Fitzpatrick, Paul

STATE OF TEXAS  
 COUNTY OF TRAVIS  
 MAR 04 2010

I hereby certify this is a true and correct copy of a  
 Texas Commission on Environmental Quality (TCEQ)  
 document, which is filed in the Records of the Commission  
 Given under my hand and the seal of office.

*Rick Thomas*  
 Rick Thomas, Custodian of Records  
 Texas Commission on Environmental Quality



Fonseca, Jacqueline  
Fulton, Carol  
Galvan, Veronica  
Gutmann, G. A.  
Gutmann, Vicky  
Hardt, Brenda Jo  
Hart, Cheri  
Hoffman, Donna  
Huff, Lois  
Izumi, Kenneth  
Kellman, Steven G.  
Landress, Judy  
Leftwich, Josh  
LeMessurier, Phillip  
Lenamon, Judy  
Long, Ted  
Lovett, Denise  
Lovett, Patrick  
Newman, Kathy B.  
Orr, Weldon Scott  
Owens, Wayne

Primrose, Ronnie  
Reed, Cyrus  
Scheurich, Manfred Mr.  
Scheurich, Mrs.  
Scheurich, Venice  
Schneider, Catherine  
Sherwood, Robin  
Smith, Margie  
Smith, Wayne  
Sonnen, Ed  
Sprinkle, Mark  
Sprinkle, Rebecca  
Sprinkle, Ryan  
Stockton, Tom  
Suter, Patricia  
Warren, Carol  
Warren, David  
Warren, Mobi  
Wilder, Kelli  
Williams, James  
Williams, Mina

If you need more information about this permit application or the permitting process, please call the TCEQ Office of Public Assistance at 1-800-687-4040. General information about the TCEQ can be found at our website at [www.tceq.state.tx.us](http://www.tceq.state.tx.us).

## I. Description of Facility

UEC has applied to the TCEQ for a new Production Area Authorization (PAA) to authorize mining and restoration in Production Area 1 within the permit area of proposed TCEQ Permit No. UR03075. The proposed activity would take place approximately 13 miles north of the city of Goliad, about 0.9 miles east of the intersection of State Highway 183 and Farm-to-Market Road 1961 in Goliad County, Texas. Production Area 1 covers approximately 36.1 acres within a 94.2 acre mine area on the southern portion of the proposed permit area.

The draft PAA, UR03075PAA1 (PAA1), includes: a mine plan with estimated schedules for mining and aquifer restoration, a baseline water quality table, a restoration table, control parameter upper limits, monitor well locations, and cost estimates for aquifer restoration and well plugging and abandonment. The draft PAA would be issued under the terms of the proposed Class III injection well area permit, TCEQ Permit No. UR03075, *which has not been issued by the TCEQ*. On November 6, 2008, the Executive Director's Response to Public Comments that was prepared on the UEC application for the area permit and request for designation of an exempt aquifer was issued. As discussed in Section II below, UEC's application for the Class III injection well area

permit and the request to designate an exempt aquifer have been referred to the State Office of Administrative Hearings for a contested case hearing.

UEC proposes to mine uranium deposits in the sands of the Goliad Formation using the *in situ* leach recovery method.<sup>1</sup> *In situ* mining is accomplished by use of Class III injection wells operating for both the injection and production of fluids. Class III wells inject fluid (lixiviant) from the surface into underground deposits of uranium ore. The lixiviant oxidizes the uranium and makes it mobile. Class III wells functioning in a production mode lift the solution bearing the uranium to the surface where resin beads remove the uranium from the solution. Reverse osmosis then reconditions the water for reuse as lixiviant for continued mining. Reverse osmosis would also be used to restore water in the mine area after the mining operation ends.

In order to mine within the requested zone, UEC must obtain an aquifer exemption. An aquifer exemption can only be issued if the portion of the aquifer does not currently serve as a source of drinking water for human consumption and, until exempt status is removed, it will not in the future serve as a source of drinking water for human consumption.<sup>2</sup>

**This Response to Comments addresses comments regarding UEC's application for PAA1.** For each production area within the production zone, TCEQ rules require UEC to obtain a Production Area Authorization (PAA).<sup>3</sup> A PAA contains localized restoration and monitoring requirements for a particular production area contained within a larger permit area. A PAA lists the monitor wells to be sampled, requires detection limits and remedial action for excursions of fluids from the production area, establishes restoration requirements, provides an estimate of when mining and restoration will be completed, and provides an estimate for the cost of plugging and abandoning all of the wells and a cost estimate for aquifer restoration. A PAA includes a mine plan, a restoration table, a baseline water quality table, control parameter upper limits, monitor well locations, and any special provisions the commission determines are appropriate.<sup>4</sup>

There are several other authorizations required for the other aspects of UEC's proposed operation. For example, prior to applying for permits from the TCEQ, UEC had been exploring the formation to learn about the uranium deposits in it. In order to drill exploration wells, UEC obtained the required exploration permit from the Texas Railroad Commission. The exploration permit is not under the TCEQ's jurisdiction; therefore, the permit and activities regulated by it will not be discussed in detail in this Response to Public Comment.

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<sup>1</sup> *In situ* leach (ISL), *in situ* recovery (ISR), and *in situ* mining are different names for the same process and are used interchangeably.

<sup>2</sup> 30 TAC § 331.13(c)(1) and (2).

<sup>3</sup> 30 TAC § 331.2 (82) Production area authorization—A document, issued under the terms of a Class III injection well area permit, approving the initiation of mining activities in a specified production area within a permit area, and setting specific conditions for production and restoration in each production area within an area permit.

<sup>4</sup> 30 TAC § 305.155.

UEC also proposes to locate a facility at the site to process the uranium after it is recovered. The processing facility will require a radioactive materials license (RML), which authorizes the recovery, possession, and processing of source material (uranium) and processing and disposal of by-product material (waste from uranium recovery).<sup>5</sup> Emissions into the air from the facility require a separate permit from the TCEQ's Air Permitting program. UEC was issued air permit by rule No. 86882 on January 15, 2009.

Finally, UEC proposes to dispose of wastewater produced during the uranium recovery process in a Class I waste disposal well. Nonhazardous operational and restoration wastewaters may be disposed of in a Class I waste disposal well. Operational wastewater includes a lixiviant bleed stream, resin wash stream, filter press wash stream and reverse osmosis brine stream. Restoration wastewater includes a simple "bleed" of the mining area (i.e., pumping more water from the mine area than is injected to ensure that mining waters do not move beyond the mine area), a reverse osmosis brine stream from restoration, or a combination thereof. UEC filed an application for a Class I waste disposal well on September 23, 2008. That application has not yet been approved by the TCEQ. The Class I injection well application is currently available for review and copying by the public at the Goliad County Courthouse, and is subject to public notice requirements, a public comment period, and the opportunity for a contested case hearing.<sup>6</sup>

**This Response to Comments does not address any of the additional authorizations UEC may require other than the PAA1 application.** Persons with questions or comments regarding other authorizations should submit comments during the specific comment period designated for the specific authorization to which that comment would apply. Doing so will ensure that the comments can be considered as potential issues in any contested case hearing on those authorizations, in accordance with applicable statutes and rules.<sup>7</sup>

## II. Procedural Background

On September 4, 2008, TCEQ received this application for new Production Area Authorization No. UR03075PAA1. On September 19, 2008, the Executive Director declared the application administratively complete. The Notice of Receipt of Application and Intent to Obtain a New Production Area Authorization (PAA) was published in the *Victoria Advocate* on September 26, 2008 and *The Texan Express* on October 1, 2008.

On June 2, 2009, the Executive Director completed the technical review of the application and prepared a draft PAA. The Notice of Application and Preliminary Decision was published in the *Victoria Advocate* on June 23, 2009 and *The Texan Express* on June 24, 2009.

<sup>5</sup> Although applications for a radioactive materials license under Tex. Health & Safety Code Ch. 401 are not subject to the House Bill 801 administrative and public participation procedures in Subchapters E and F of 30 TAC Ch. 55, they are subject to Subchapter G, Requests for Contested Case Hearing and Public Comment on Certain Applications (§§ 55.250-55.256). Tex. Health & Safety Code § 401.264 provides for notice and an opportunity for contested case hearing.

<sup>6</sup> 30 TAC § 39.651 and Ch. 55, Subch. E and F (§ 55.150 et. seq.) and Tex. Water Code § 27.018.

<sup>7</sup> 30 TAC § 55.201(d)(4).

On August 14, 2009, UEC filed a request that the application for PAA1 be referred directly to the State Office of Administrative Hearings (SOAH) for a contested case hearing on the application.

A public meeting was held on October 5, 2009, in Goliad. The public comment period was extended to the conclusion of the public meeting.

On October 6, 2009, SOAH held a preliminary hearing in Goliad to take jurisdiction over the matter and consider requests for party status. UEC filed a motion to consolidate the hearing on the application for PAA1 with the pending hearing on the applications for the Class III injection well area permit and aquifer exemption designation; the motion was granted. The consolidation means that there will be one contested case hearing under SOAH Docket No. 582-09-3064 and TCEQ Docket No. 2008-1888-UIC to address the application for the Class III injection well area permit, the aquifer exemption, and the application for PAA1.

On November 6, 2009, UEC submitted an amendment to the application for the Class III injection well permit and the PAA to reflect changes to its plans for the uranium processing facility. UEC's amendments reflect that the final stages of uranium recovery (elution, precipitation, filtering, and drying) would occur at an off-site location, rather than at the Goliad facility. These amendments result in a smaller footprint of the Goliad processing facility. Additionally, the amendment revises the projected volume of water consumption from 2,417 acre-feet to 1,169 acre-feet.

Because new information may be presented in the contested case hearing process, the Executive Director will continue to consider all information in making final recommendations on these applications to the Commissioners of the TCEQ. The Commissioners will make the final decision on whether to approve the applications and issue the permits and authorizations.

### III. Access to Rules, Laws and Records

The following Web sites contain rules, statutory law, and other information that applies to this application.

Texas statutes	<a href="http://www.statutes.legis.state.tx.us/">www.statutes.legis.state.tx.us/</a>
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TCEQ rules, codified in	<a href="http://www.tceq.state.tx.us/nav/rules/current.html">www.tceq.state.tx.us/nav/rules/current.html</a>
Title 30, Texas Administrative Code	and
	<a href="http://www.sos.state.tx.us/tac">www.sos.state.tx.us/tac</a>

Secretary of State	<a href="http://www.sos.state.tx.us">www.sos.state.tx.us</a>
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Federal statutes and rules	<a href="http://www.epa.gov/lawsregs/">www.epa.gov/lawsregs/</a>
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Commission records for this facility are available for viewing and copying at TCEQ's main office in Austin, 12100 Park 35 Circle, Building F, 1<sup>st</sup> Floor, Office of the Chief

Clerk. The application has also been available for review and copying at the Goliad County Courthouse since the publication of Notice of Receipt of Application and Intent to Obtain a New Production Area Authorization. The technical summary and draft PAA have also been available at that location since publication of the Notice of Application and Preliminary Decision.

#### IV. Comments and Responses

Comments have been grouped under the following subject-matter headings:

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|---|--|
| A. Procedural Issues and Concerns                             | M. Monitoring  |
| B. Uranium Industry, generally                                | N. Control of Migration                                |
| C. Laws and Rules, generally                                  | O. Spill and Excursion Response and Cleanup            |
| D. Data Concerns  | P. Contamination of Surface Water, Air, and Soil       |
| E. Economic Impacts and Quality of Life                       | Q. Restoration of Aquifer: Feasibility and Enforcement |
| F. Groundwater Quality  | R. Financial Assurance                                 |
| G. Groundwater Quantity/Availability                          | S. Enforcement: Inspections and Penalties              |
| H. Concerns related to mining in a USDW or unconfined aquifer | T. Aquifer Testing                                     |
| I. Aquifer Exemption  | U. Miscellaneous                                       |
| J. Geology/Hydrology of the Aquifer                           |  |
| K. Baseline Determination                                     |  |
| L. Degradation of Water Quality during Exploration Phase      |  |

#### A. PROCEDURAL ISSUES AND CONCERNS

##### Comment 1

Ray and Kathy Albrecht commented that they strongly oppose issuance of this PAA. Raymond and Karon Arnold strongly protested issuance of this PAA. Monica Diaz Black requested that UEC not be allowed to conduct *in situ* mining operation at the proposed site.

##### Response 1

The Executive Director reviewed the application under the applicable requirements of Texas Water Code Chapter 27 and 30 TAC Chapter 331 and made a preliminary determination that the application meets all of the applicable requirements. The application has been referred to a contested case hearing at the State Office of Administrative Hearings, and the Executive Director will continue to consider all information presented in the hearing in making a final recommendation to the commission.

##### Comment 2

The TCEQ received 76 requests for a public meeting on UEC's application for Production Area Authorization No. 1 (PAA1). Joan Fabian, Jacqueline Fonseca, Carol

Fulton, Veronica Galvan, Cheri Hart, Donna Hoffman, Lois Huff, Kenneth Izumi, Steven G. Kellman, Barbara Allen-Lampley, Judy Landress, Philip LeMessurier, Kathy B. Newman, Wayne Owens, Catherine Schneider, Ed Sonnen, Mark Sprinkle, Rebecca Sprinkle, Ryan Sprinkle, Mobi Warren, and Kelli Wilder stated that citizens have a right to a public meeting where questions regarding the establishment of pre-mining groundwater quality can be addressed, and each of these persons requested the TCEQ hold a public meeting in Goliad County.

#### **Response 2**

A public meeting on this application was held on Monday, October 5, 2009, at 7:00 p.m. at the Goliad County Courthouse, 127 North Courthouse Square, Goliad, Texas, 77963. In addition to comments submitted during the formal comment period, comments submitted at this meeting are addressed in this Response to Public Comment.

#### **Comment 3**

The TCEQ received 30 requests for a contested case hearing on UEC's application for PAA1.

#### **Response 3**

On August 14, 2009, UEC filed a request for this application to be referred directly to the State Office of Administrative Hearings under 30.TAC §55.210. The request was granted, as required by rule, and the application was referred to SOAH for a contested case hearing. SOAH held a preliminary hearing to consider requests for party status to the hearing on October 6, 2009 at the Goliad County Courthouse, 127 North Courthouse Square, Goliad, Texas, 77963. At this preliminary hearing, the contested case hearing for UEC's PAA1 application was consolidated with the hearing for the Class III injection well area permit application, and a new hearing schedule was adopted. All parties to the original Class III injection well area permit remained parties in the consolidated hearing; no new parties were identified. The issues referred by the commission to be considered in the original contested case hearing on the application for the Class III injection well area permit will continue to apply in the consolidated hearing. The contested case hearing will now include the issue of whether the application for PAA1 meets all applicable requirements.

#### **Comment 4**

Patricia Suter and Venice Scheurich of the Coastal Bend Group of the Sierra Club (CBGSC) noted that there was an error in the determination of baseline for the proposed production area, which was brought to the TCEQ's attention by members of CBGSC, and asked what provision TCEQ is taking to prevent the issuing of future draft PAAs that might contain similar errors.

#### **Response 4**

CBGSC is correct that there was an error in the determination of baseline for the proposed PAA1. David Murry of the TCEQ staff was made aware of this error by Ms. Venice Scheurich on July 9, 2009.<sup>8</sup> Specifically, Ms. Scheurich noted that although the

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<sup>8</sup> Telephone call from Ms. Scheurich to David Murry.

average values for uranium and radium-226, based on analysis of groundwater samples from the 18 baseline wells, were reported to be 0.151 milligrams per liter (mg/l) and 404 picocuries per liter (pCi/l), respectively,<sup>9</sup> these actual values are 0.115 mg/l and 333 pCi/l, respectively. Subsequent investigation by UEC determined that the values from well PTW-7 were inadvertently included twice in the spreadsheet UEC used to calculate average values for the groundwater quality constituents. For many of the constituents, this error did not appreciably change the averages. However, it resulted in a significant change for uranium and radium. This error was not detected by TCEQ because the average values were not checked for all 26 constituents. In the future, all averages will be checked. The error was corrected and the application now reflects the corrected values. The error does not change the Executive Director's recommendation on the application. The values in the restoration table of the draft PAA have been corrected.

#### **Comment 5**

Raymond and Karon Arnold requested that the TCEQ work with affected parties, the Goliad County Groundwater Conservation District, and the Goliad County Commissioner's Court to include in UEC's Production Area Authorization provisions to protect water quality, water quantity, and air quality.

#### **Response 5**

The TCEQ works with affected parties through the formal permitting process, which includes public notice, opportunity for public comment, and opportunity for a contested case hearing. State regulations that apply to *in situ* uranium mining are designed to protect the state's groundwater resources. Enforcement of the provisions in a PAA is the responsibility of the TCEQ.

#### **Comment 6**

Brenda Jo Hardt asked why UEC made revisions to this application, but did not update the copy of the application at the Goliad County Courthouse with these revisions, and requested the TCEQ identify the ten most significant revisions to the application.

#### **Response 6**

UEC was required to provide a copy of the application where it could be viewed by the public, and a copy of the application was placed in the Goliad County Courthouse. UEC submitted to the Chief Clerk of the TCEQ a signed verification dated June 30, 2009, stating that the application and revisions were maintained at the Goliad County Courthouse.

In its February 19, 2009 response to the Executive Director's notice of deficiency letter (NOD) dated January 23, 2009, UEC submitted the following application revisions:

1. Two production zone monitor wells were added;
2. An additional geologic cross-section, E-E', was added;
3. Figures 5-3 and 5-4, which are potentiometric maps for Sand B and Sand A, respectively, were revised, and water level data used to construct these maps was provided;

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<sup>9</sup> UEC PAA1 application, Table 5.3, Table 6.1, and Table 6.2.



4. Geophysical logs for wells 32201-N119, 32210-126, and BMW-9, which were not included in the original application, were provided;
5. Color copies of figures 4.7, 4.8, 4.9, and 4.10, which are graphs of the response of monitor wells to the pump tests, were provided;
6. Clarification of adjustments to the pump test data for barometric pressure was provided;
7. Clarification of the effect of screen length on the pump test data was provided;
8. Documentation that the analytical data in Appendix A is from an accredited laboratory was provided; and
9. Discrepancies between analytical values reported in Table 5.1 and the laboratory reports in Appendix A were corrected.

Additionally, on August 24, 2009, UEC submitted revisions to the application to address changes to the proposed restoration table (Table 6.2). These revisions were necessary to address incorrect averages and standard deviations for uranium and radium that were provided in Table 5.2. The draft PAA has been revised.

On November 6, 2009, UEC submitted an amendment to the application for the Class III injection well permit and the PAA to reflect changes to its plans for the uranium processing facility. UEC's amendments reflect that the final stages of uranium recovery (elution, precipitation, filtering, and drying) would occur at an off-site location, rather than at the Goliad facility. These amendments result in a smaller footprint of the Goliad processing facility. Additionally, the amendment revises the projected volume of water consumption from 2,417 acre-feet to 1,169 acre-feet.

#### **Comment 7**

Ted Long commented that the TCEQ is allowing UEC to apply for one permit at a time. Mr. Long stated this allowance is discriminatory to the people of Goliad County, as they are forced to contest each application. According to Mr. Long, UEC has an unfair advantage by being a large corporation with significantly more funding than Goliad County.

#### **Response 7**

State regulations allow for consolidated permit processing but only at the request of the applicant;<sup>10</sup> the TCEQ does not have the legal authority to require an applicant to submit all required applications at the same time. Depending on the timing of the processing of different applications and the determination of any requests for hearing, contested case hearings on the various applications can be consolidated if it will not prejudice any party and may save time or expense or otherwise benefit the public interest and welfare.<sup>11</sup> The Executive Director notes that the Class III injection well area permit and the request for an aquifer exemption were submitted as one application, were processed together, and were included in the same hearing. Also, at the request of UEC, the application for PAA1 has been consolidated for hearing with the application for the Class III injection well area permit and the aquifer exemption.

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<sup>10</sup> 30 TAC § 33.11.

<sup>11</sup> 30 TAC § 80.13.

#### **Comment 8**

CBGSC asked if the proposed restoration table, which contained an error in the sample mean and sample deviation due to inclusion of the PTW-7 well data twice has been corrected, and if the corrected table is available to the public.

#### **Response 8**

UEC submitted revisions to the PAA application to correct this error.<sup>12</sup> UEC has maintained a copy of the application for public viewing at the Goliad County Courthouse. The corrected table is in the draft PAA.

### **B. URANIUM INDUSTRY, GENERALLY**

#### **Comment 9**

John and Wanda Duke stated that although in general they are not opposed to uranium mining, provided it can be done in a safe manner and will not jeopardize the health and welfare of individuals, livestock, and wildlife, they do not believe there has been sufficient research to demonstrate *in situ* uranium mining can be done in a safe manner, especially when the mining is within an aquifer that provides drinking water for human consumption. The Dukes emphasized that the proposed mining will be within the Evangeline Aquifer, which is the drinking water source for Goliad County. Also, they stressed that because of an absence of more stringent assurances, stricter monitoring guidelines, and more and better data, they are opposed to the issuance of this production area authorization.

#### **Response 9**

The Executive Director reviewed UEC's application for PAA1 and determined that it meets all requirements for this type of authorization. Based on the information in the application and on applicable requirements in 30 TAC Chapter 331, the Executive Director has prepared a draft PAA that includes requirements protective of groundwater in the area.

The rules that govern *in situ* uranium mining have been developed through open rulemaking processes, with input from legislators, other elected officials, professionals from regulatory bodies, citizen groups, industry and the public, to protect groundwater from contamination and ensure that people can live and work safely in the vicinity of such operations. The United States Environmental Protection Agency (EPA) approved the TCEQ's underground injection control program in 1986, and conducts annual reviews of the program. In over 30 years of *in situ* uranium mining at over 30 sites in Texas, there is no evidence that off-site groundwater has ever been contaminated due to this type of mining.

#### **Comment 10**

Brenda Jo Hardt expressed the opinion that *in situ* uranium mining cannot be done without affecting groundwater quality. She emphasized that many cities are struggling to

<sup>12</sup> August 24, 2009 letter from Josh Leftwich, UEC, to TCEQ.

meet future water needs, and that these needs are more important than uranium mining. She stated that uranium is not renewable, and that higher grade uranium deposits exist in Canada and other countries. Lastly, she stated that the United States government cannot guarantee loans for new nuclear power plants, and that countries such as France and Germany are no longer pursuing further development of nuclear power.

#### **Response 10**

The Texas Injection Well Act (Texas Water Code Chapter 27) and the TCEQ's Underground Injection Control Program rules (30 TAC Chapter 331) specifically authorize the use of injection wells for the recovery of uranium. The Executive Director's staff reviewed UEC's PAA application and determined that it meets all regulatory requirements. Neither the statutes noted nor the applicable rules authorize the TCEQ to deny issuance of a PAA based on water use or the renewability of uranium. The Executive Director acknowledges that higher grade uranium ore deposits may exist in Canada and other countries such as Australia, but the applicable requirements on a PAA application do not consider the availability of uranium elsewhere. Likewise, the TCEQ does not consider the financing of nuclear power projects or the pursuit of nuclear energy by other nations in the review of a PAA application.

### **C. LAWS AND RULES, GENERALLY**

#### **Comment 11**

Ronnie Primrose commented that the current laws that apply to *in situ* uranium mining offer inadequate protection to citizens and the environment, and that the existing laws favor mining companies. David and Carol Warren asked what regulations will be in place to protect citizens from groundwater contamination. They also asked who will form these regulations and who will enforce them. The Warrens also ask how existing agencies make better laws to protect citizens and how the TCEQ enforces the laws. The Warrens and Ronnie Primrose ask that the TCEQ deny UEC's PAA application until more protective regulations are adopted, along with better ways to enforce them.

#### **Response 11**

The Executive Director implements the statutes and rules as they are written. The primary laws in place to protect residents are found in Chapter 27 of the Texas Water Code and Chapter 331 of Title 30 of the Texas Administrative Code. The application for the PAA was reviewed and considered under these laws. The Water Code statutes are adopted through the legislative process, and the TCEQ rules are promulgated by the TCEQ through a formal administrative rulemaking process, which includes opportunities for public input. The TCEQ enforces these regulations through its Office of Compliance and Enforcement, which includes local field offices throughout the state.

#### **Comment 12**

David and Carol Warren ask whether punitive damages can be assessed in the event of surface contamination.

### **Response 12**

The TCEQ enforces the permit, PAA, and rule requirements and can initiate an enforcement action which may result in the issuance of an enforcement order. An enforcement order requires payment of a fine, and if appropriate, sets out corrective actions the permittee must take to come into compliance. The TCEQ may seek administrative penalties of up to \$10,000 a day for each violation and civil penalties of up to \$25,000 a day for each violation.<sup>13</sup> If the permittee fails to remit the fine imposed, the case is referred to the Texas Office of the Attorney General for collection. Failure to comply with an ordering provision for corrective action is an independent violation and can result in additional enforcement actions at the TCEQ. Also, the TCEQ can refer a case to the Office of the Attorney General, who may pursue an injunction to require the permittee to perform the corrective actions in the TCEQ enforcement order.

The amount of the fine imposed in an enforcement case is determined by using the TCEQ Penalty Policy in force at the time the violation is screened by the enforcement division. The current Penalty Policy is available to the public on TCEQ's website at [http://www.tceq.state.tx.us/comm\\_exec/forms\\_pubs/pubs/rg/rg-253/](http://www.tceq.state.tx.us/comm_exec/forms_pubs/pubs/rg/rg-253/).

In addition to administrative penalties, a person may also be subject to criminal liability for knowingly or intentionally violating a requirement of the Injection Well Act, a requirement of TCEQ rule, or a TCEQ permit or PAA.<sup>14</sup>

### **Comment 13**

David and Carol Warren ask what protection surrounding landowners have and how citizens can be assured the mining company will honor the applicable laws. Ted Long asked what provisions are in place to require UEC to adequately compensate parties adversely affected by damages from mining.

### **Response 13**

The fact that a person has an injection well permit or PAA does not relieve the person of any civil liability. The issuance of the permit does not authorize any injury to persons or property or an invasion of property rights, or any infringement of state or local law or regulations. Individuals may protect their rights by contacting local law enforcement or seeking redress in a civil legal proceeding. Individuals are encouraged to report any concerns or suspected noncompliance with the terms of any permit or environmental regulation to the TCEQ by contacting the Corpus Christi Regional Office at 361-825-3100, or by calling the 24-hour toll-free Environmental Complaints Hotline at 1-888-777-3186. The TCEQ investigates all complaints received in a timely manner. If the facility is found to be out of compliance with the terms and conditions of its permit, it will be subject to enforcement action.

### **Comment 14**

GCGCD commented that a minimum of 1% bleed is required during *in situ* mining.

<sup>13</sup> Tex. Water Code §§ 7.052, 7.102.

<sup>14</sup> Tex. Water Code § 7.157.

#### Response 14

A permittee is required to confine mining solutions to the production zone within the area of designated production zone monitor wells under 30 TAC §331.102. Maintaining a bleed is one method for ensuring confinement of mining solutions.<sup>15</sup> The Executive Director is not aware of any Texas statute or regulation that includes a requirement to maintain a minimum bleed of 1% during *in situ* mining operations. The Executive Director notes that a bleed of 1% is typical for *in situ* uranium mining operations in South Texas.<sup>16</sup>

#### D. DATA CONCERNS

##### Comment 15

CBGSC provided several comments regarding the determination of baseline water quality:

1. CBGSC asked why there is a dramatic difference in values for uranium and radium-226 between the September 2008 proposed restoration table and the March 2009 table. Specifically, CBGSC asked why the analytical results from baseline wells PTW-7 through PTW-14 differ so strikingly when compared to those from baseline wells PTW-1 through PTW-6.
2. CBGSC noted that results from analysis of groundwater samples from the original ten baseline wells had an average uranium value of 33 micrograms per liter, but the average for the additional eight baseline wells was 21.8 micrograms per liter.
3. CBGSC commented that correcting the error in the baseline data resulted in the average value for uranium changing from 15.1 micrograms per liter to 11.5 micrograms per liter.
4. CBGSC emphasized that the lowest uranium value from the eight additional baseline wells (PTW-7 through PTW-14) was 86 micrograms per liter, which is greater than the maximum value of 80 micrograms per liter from the initial ten baseline wells.

Similar concerns were expressed by GCGCD, which questioned the validity and consistency of this data. Cyrus Reed of the Lone Star Chapter of the Sierra Club commented that there are differences in the concentrations of uranium found in the initial baseline well groundwater samples and those from subsequent samples. GCGCD also commented that to allow restoration to those high levels of contamination will leave a large volume of contaminated water in Sand B that will migrate downdip, potentially threatening the health of many current and future residents. GCGCD questioned whether the TCEQ will allow this potential to exist. In reference to its concerns regarding the data from the baseline wells, GCGCD questioned whether or not the data from the 18 baseline wells accurately represents the water quality prior to exploration. Mr. and Mrs.

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<sup>15</sup> The term "bleed" refers to the rate at which fluid is withdrawn during *in situ* mining operations minus the rate at which fluid is injected during these operations. More fluid is withdrawn than is injected during mining operations in order to direct the injected fluids toward the recovery wells, thereby restricting the injected fluid to the production zone within the production area.

<sup>16</sup> Kohler, D. P., 1984, *Underground Injection Operations in Texas*, Tex. Dept. Water Res., Report 291, page 4-8.

Manfred Scheurich expressed the concern that there was a lack of use of sound scientific methods to accurately assess pre-mining groundwater quality.

#### Response 15

UEC originally submitted baseline information in 2008 for baseline wells PTW-1 through PTW-6. In 2009, UEC submitted additional baseline information for PTW-7 through PTW-14 in order to meet the new baseline well requirement of the revised TCEQ rule in 30 TAC §331.104(c). The concentrations of uranium and radium-226 in groundwater samples vary through the production zone within the production area, both horizontally and vertically, and based on proximity to uranium mineralization. Uranium and radium-226 values from groundwater samples taken from the baseline wells appear to be a function, at least in part, of screen length, screen placement, and vertical distribution of uranium mineralization. Ten of the baseline wells had respective screen lengths of 19.4 to 24.79 feet, two had respective screen lengths of 14.43 to 15 feet, three had respective screen lengths of ten feet, and two had respective screen lengths of five feet (see following table). The highest uranium and radium-226 values were in wells with screen lengths of 20 feet (PTW-7) and 14.43 feet (RBLB-5).

Well #	Screen Length (ft)	Screen Placement*	U (mg/l)	Ra-226 (pCi/l)
PTW-1	20	Above ore	0.032	17.0
PTW-2	20	In ore	0.009	17.0
PTW-3	20	Partially in ore	0.009	38.0
PTW-4	20	Partially in ore	0.059	196.0
PTW-5	20	Below ore	0.005	357.0
PTW-6	20	In ore	0.010	202.0
PTW-7	20	In ore	0.804	1884.0
PTW-8	10	In ore	0.134	397.0
PTW-9	5	In ore	0.135	394.0
PTW-10	10	In ore	0.099	68.0
PTW-11	10	In ore	0.166	296
PTW-12	5	In ore	0.163	477.0
PTW-13	20	In ore	0.156	10.0
PTW-14	15	In ore	0.086	224.0
RBLB-1	24.79	In ore	0.062	393.0
RBLB-3	19.40	Above, partially in Overlying confining zone	0.080	110.0
RBLB-4	19.44	In ore	0.006	37.2
RBLB-5	14.43	In ore	0.060	1090

UEC has proposed restoration values based on the arithmetic mean, which was calculated using the data from these 18 baseline wells. This method is allowed under 30 TAC §331.107(a)(1)(A). The Executive Director regards the data to be valid and has no information or evidence to suggest that the data is inaccurate. During mining operations, UEC is required to confine mining solutions to the production zone within the production

area,<sup>17</sup> which would be accomplished in part by maintaining a bleed.<sup>18</sup> UEC also is required to install and operate monitor wells, both in the production zone and in overlying Sand A, for detection of any excursions of mining fluids, and to address any excursions in accordance with the requirements at 30 TAC §331.106 (Relating to Remedial Action for Excursion Control). Once mining is complete, UEC is required to restore the groundwater in the mined portion of Sand B in accordance with the requirements at 30 TAC §331.107 (Relating to Restoration). For these reasons, the Executive Director does not agree that a large volume of contaminated water in Sand B will migrate downdip and pose a potential threat to human health and the environment.

#### **Comment 16**

CBGSC asked if something occurred during the time between drilling and testing of the first set of ten baseline wells and that of the additional eight baseline wells.

#### **Response 16**

The Executive Director is not aware of the occurrence of any event between drilling and testing of the RBLB (Regional Baseline Sand B) wells, PTW-1 through PTW-6, and PTW-7 through PTW-14 that would influence the levels of constituents in groundwater samples from these wells.

#### **Comment 17**

Josh Leftwich with UEC commented that the typographical error discovered in the application has been corrected. The error was on Table 5.2 (Production Zone (Sand B) Water Quality). As explained by Mr. Leftwich, a spreadsheet was used to compute the high, low, and average value for each of the 26 constituents listed in this table. The values for well PTW-7 inadvertently were included twice, resulting in high average values for uranium and radium-226 on the proposed restoration table in the final draft PAA.

#### **Response 17**

The Executive Director has received a revision to the application to correct this error, and this revision has been placed in the application. The draft PAA has been revised.

#### **Comment 18**

GCGCD commented that the UEC application contained no discussion of how wells were developed, nor did UEC provide records of the amount of water removed from each well during development. GCGCD emphasized that the installation of a groundwater well is considered to be a major source of contamination introduced into an undisturbed aquifer. GCGCD further stated that in the case of a well drilled into a uranium ore body, the introduction of oxygen during the drilling and development of the well will initiate the process of slowly dissolving the ore, which may result in the elevated concentrations of constituents such as uranium, arsenic, selenium, molybdenum and sulfur in samples collected from the well. Lastly, GCGCD stated that proper well development is needed to remove sediment and contamination prior to collecting samples.

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<sup>17</sup> 30 TAC §331.102.

<sup>18</sup> UEC Class III UIC application, pp. 9-14.

### Response 18

Well development is the process of cleaning out and removing materials (such as drilling mud and cement) that were introduced into the well during the drilling and installation of the casing and well screen so that the well can be put into service. The Executive Director notes that although UEC's application for a Class III injection well area permit contains a detailed description of the proposed well design and construction methods, neither it nor the PAA application contain a discussion of how wells are developed. According to discussions with UEC representatives, all wells are developed in the following manner:

1. Once a well is completed, an air line is lowered into the casing, and the well screen is jetted with air to remove any scale or mud from the screen;
2. The well is then pumped until the produced water is clean; generally this takes about 2 hours; the amount of water pumped is recorded.
3. The well is allowed to rest for approximately two weeks; then groundwater is sampled for pH as a quality check; pH of Goliad Formation water consistently is in the range of 7-8.

While there are no specific rule requirements with respect to well development, the Executive Director finds these procedures to be acceptable, and does not agree that the introduction of air at the well screen will initiate dissolution of the ore, resulting in elevated concentrations of constituents such as uranium, arsenic, selenium, molybdenum and sulfur in the groundwater. As described in UEC's Class III injection well area permit application,<sup>19</sup> oxygen is required for the dissolution of uranium. To accomplish this, pure oxygen, not air (which contains about 21% oxygen) is continuously added to the mining fluid. Also, a complexing agent, such as bicarbonate, is added to aid in keeping the uranium in solution. For these reasons, the Executive Director finds insufficient evidence to conclude that air, introduced for a limited amount of time at the well screens, will result in the initiation of the *in situ* process, and, that once initiated, the process will self-perpetuate.

### Comment 19

GCGCD commented that the turbidity of a groundwater sample should be below five nephelometric turbidity units (NTUs),<sup>20</sup> and that a sample whose turbidity is above five NTUs has a considerable amount of suspended particles. GCGCD noted that the laboratory reports in Appendix A of UEC's application indicate that for samples from three of the nine OMW (overlying monitor well) wells, eleven of the 22 BMW (sand B monitor well) wells, and five of the six PTW (pump test well) wells, the NTU value for each exceeded five NTUs. GCGCD also noted that many of the elevated uranium concentrations are associated with wells that have high NTU values, which may indicate radium is one of the suspended particles in the samples. GCGCD emphasized this conclusion is logical as radium ions are known to adsorb onto clay particles. GCGCD stated that the elevated NTU values indicate suspended particles in the sample and suggests that well development was incomplete prior to sampling.

<sup>19</sup> UEC Class III UIC area permit application, Section 9.0.

<sup>20</sup> One NTU is defined as 1 milligram of finely divided silica in a liter of water.



#### **Response 19**

According to notes on the laboratory reports in Appendix A of UEC's PAA1 application, samples with high turbidity also contained hydrogen sulfide gas,<sup>21</sup> which affects the clarity of the groundwater samples. Therefore, the level of turbidity most likely is due to the hydrogen sulfide gas dissolved in the groundwater, not suspended particles. Also, the Executive Director notes that all samples are filtered prior to analysis, which will remove suspended particles. With regard to adsorption of ions onto clay particles, the Executive Director would anticipate that this process would affect other ions as well, especially the more abundant ones such as sodium, chloride, calcium, and magnesium. Based on the groundwater sample analyses, there is no obvious correlation between the concentration of these constituents and the turbidity of the sample.

#### **Comment 20**

GCGCD commented that when the sample collection dates provided on the laboratory reports in Appendix A of UEC's application are compared with the well completion dates in Appendix C, there appears to be two to four weeks between well completion and sampling for the PTW wells, five to nine weeks for the BMW wells, and four to five weeks for the OMW wells. GCGCD asked what the basis is for the different periods between well groups. GCGCD stated their concern is that a shorter development time for the PTW wells could indicate the aquifer was still in a disturbed state when the samples were collected, which it says is suggested by the elevated NTU measurements. GCGCD stated that this is significant because the PTW well samples are from the ore-bearing zone, and disturbance of this zone suspends micron-sized particles from the ore body into the groundwater, and these particles could result in anomalously high measurements of uranium and radium in the groundwater. GCGCD recommended a minimum of four samples from each well, with a minimum of two weeks between sampling events, to ensure representative samples were collected during the initial sampling event.

#### **Response 20**

The Executive Director does not find any significance in the amount of time between well completion and sampling. As discussed in Response 18, once developed, all wells are allowed to stand for at least two weeks, and then are sampled for pH as a quality check. Also as discussed in Response 18, prior to analysis, all samples are filtered to remove any suspended particles. With regards to the recommendation of a minimum of four samples per well, the Executive Director notes that baseline was not determined on an individual well basis, but on the basis of the entire area of the PAA. Baseline determination was based on sample results from 18 wells, which meets the requirements of 30 TAC §331.104 (Relating to Establishment of Baseline and Control Parameters for Excursion Detection).

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<sup>21</sup> The presence of H<sub>2</sub>S indicates reducing conditions.

#### **Comment 21**

GCGCD commented that the Nuclear Regulatory Commission (NRC)<sup>22</sup> and the United States Environmental Protection Agency (EPA)<sup>23</sup> each have stated that acceptable sampling procedures must be used for sample collection, and asked what procedures were followed to measure field parameters, collect the samples, and ensure container integrity between collection and analysis.

#### **Response 21**

On the Production Area Authorization Form,<sup>24</sup> TCEQ Technical Guideline I-*Groundwater Analysis*, is referenced. This document provides guidance regarding the collection and analysis of groundwater samples. UEC describes use of Technical Guideline I *Groundwater Analysis* and EPA's *Methods for Chemical Analysis of Water and Wastes* in Section 4.1, *Methods*, of the application for the Class III injection well area permit.

#### **Comment 22**

GCGCD commented that no completion reports for the OMW and BMW wells were included in Appendix C of UEC's PAA1 application, and noted that available information in Appendix C indicates wells have screen lengths of 20 feet, which is less than half the 45 to 50 foot thickness of Sand B. GCGCD emphasized the importance of knowing what the screen length is in these wells to determine if samples collected from these wells were obtained from the entire thickness of Sand A and Sand B. GCGCD stated that the NRC has discussed the importance of screening the entire thickness of the sand unit at the well to ensure representative groundwater samples are collected.

#### **Response 22**

Appendix C of the application contains completion reports for these wells. Based on these records, Sand A varies in thickness from about 55 feet to 60 feet. Well screen lengths in the OMW wells are 20 feet in length, and have been set across the lower portion of Sand A. Sand B ranges in thickness from 42 to 62 feet across the proposed production area, with an average thickness of about 48 feet. Well screens in the BMW wells are 20 feet in length and are set across the central or lower part of Sand B. Baseline well screen lengths were provided in Response 15.

On pages 5-42 and 5-43 of the guidance document referenced above by GCGCD, the NRC provides a discussion on screen lengths. For most situations, the NRC favors wells that are screened over the entire thickness of the aquifer being monitored (generally referred to as "fully penetrating wells") because fully penetrating wells will provide a groundwater sample from the entire thickness of the unit being monitored. However, NRC cautions that in fully penetrating wells, the concentration of indicator parameters may be diluted and therefore may not provide timely warning that an excursion is

<sup>22</sup> US NRC, 2003, *Standard Review Plan for In Situ Leach Uranium Extraction License Applications*, NUREG-1569.

<sup>23</sup> US EPA, 1992, *RCRA Ground-Water Monitoring: Draft Technical Guidance*.

<sup>24</sup> Available at:

[http://www.tceq.state.tx.us/permitting/waste\\_permitting/uec\\_permitting/IGC\\_Guidance\\_Class\\_3.html](http://www.tceq.state.tx.us/permitting/waste_permitting/uec_permitting/IGC_Guidance_Class_3.html)

occurring. The NRC did state that with a fully penetrating well, an excursion would eventually be detected. According to the NRC, samples from wells that are screened over a portion of the aquifer being monitored ("partially penetrating well"), usually over the zone being mined, would suffer less from dilution, but may miss an excursion if it passed above or below the screen. The NRC emphasized that partially penetrating wells only sample the zone of extraction.

According to the application, UEC does not intend to perform *in situ* mining within Sand B, the production zone, over the entire 40 to 50-foot thickness of the sand. Screens in the injection and production wells would be installed across zones that UEC has determined contain sufficient mineralization to warrant mining. Injected mining fluids tend to travel from the screened interval in the injection well to the screened intervals in the adjacent production wells, although some vertical mixing will occur within Sand B. A plume of mining fluid migrating outward from the production area would expand both horizontally and vertically within Sand B. Given that the 20-foot screens in the production zone monitor wells cover 40 to 50% of the thickness of Sand B, such a plume would most likely intercept the screened interval of a monitor well, allowing for detection of the excursion. Screening the entire thickness of Sand B in the production zone monitor wells would result in diluting the groundwater sample.

The OMW wells are screened across the lowermost part of Sand A (see also Response 84), which will provide early indication of an excursion from Sand B to Sand A, should one occur.

#### **Comment 23**

GCGCD commented that the well logs and completion reports for the PTW (Pump Test Wells) wells indicate that they were screened only in the lower half of Sand B, generally across the ore-rich zones. GCGCD also noted this was true for the RBLB wells.<sup>25</sup> GCGCD contends this produces sample results that are biased high, and notes that NRC recognizes this bias, and states that fully screened intervals provide samples that are more representative of groundwater quality.<sup>26</sup> GCGCD stated that fully screened interval, or multiple shorter screened intervals through the entire thickness of sand are the only methods to ensure representative samples, and therefore the analytical results from samples collected from the PTW and RBLB wells are invalid for calculating pre-mining groundwater quality. Lastly, GCGCD stated that a similar conclusion applies to the analytical results for the BMW and OMW wells if the respective screened intervals in these wells do not span the entire sand thickness.

#### **Response 23**

The PTW wells are screened across the ore-bearing zones because it is these zones that will be mined and will be affected by the mining fluids, and it is these zones that will have to be restored. Therefore, it is the pre-mining groundwater quality of these zones that must be determined.

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<sup>25</sup> UEC Class III Injection Well Application.

<sup>26</sup> NUREG-1569, *Standard Review Plan for In Situ Leach Uranium Extraction License Applications*, pg. 5-43.

The Executive Director notes that if pre-mining groundwater quality was based on samples from fully penetrating wells, a determination of restoration would also be determined on samples from those same wells.

#### **Comment 24**

GCGCD commented that one sample from each well is insufficient for determination of pre-mining groundwater quality because drilling of the wells disturbed the aquifer, and seasonal variation in water quality may occur. GCGCD stated that a minimum of four samples must be collected from each well, with adequate time between samples to identify anthropogenic or natural variations, as recommended by the NRC.<sup>27</sup> GCGCD noted that the EPA recommends a minimum of eight samples over a period of one year.<sup>28</sup> GCGCD commented that one sample per well, along with the possibility that the wells were incompletely developed, make the conclusions regarding water quality presented in Section 5.0 of UEC's application invalid.

#### **Response 24**

As discussed in Response 18, the Executive Director finds the methods UEC used to develop the wells to be acceptable, and does not agree that these wells were incompletely developed. With regard to GCGCD's reference to EPA guidance, the specific reference cited by GCGCD was on page 78 of the guidance document,<sup>29</sup> which contains part of the discussion of the use of control charts for groundwater monitoring. Upon review of the portion of the EPA document cited by GCGCD, the Executive Director did not find the basis for GCGCD's assertion that the EPA recommends a minimum of eight samples over a period of one year. However, the Executive Director acknowledges that the EPA emphasizes that estimates of the background mean and variance are improved by additional data collected over time.

The collection of multiple samples from each well generally is required if the statistical method to be used requires estimates of the mean and standard deviation from each well, such as in the use of ANOVA,<sup>30</sup> or in the case of the use of an intra-well comparison methodology.<sup>31</sup> UEC's statistical method, which is discussed in Response 74, is based on the data from all 18 baseline wells. Therefore, estimates of the mean and standard deviation from each well are not necessary.

#### **Comment 25**

GCGCD commented that according to EPA<sup>32</sup> and the American Society for Testing and Materials (ASTM)<sup>33</sup> guidance documents, use of the mean or standard deviation to

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<sup>27</sup> Ibid, pg. 5-39.

<sup>28</sup> EPA, 1992, *Addendum to Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities*, OSW, page 78.

<sup>29</sup> Ibid, and Comment 5, GCGCD 07/10/09 comment letter on UEC's PAA1 application.

<sup>30</sup> EPA, 1989, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities*, OSW, page 5-5.

<sup>31</sup> Ibid, page 7-1.

<sup>32</sup> EPA, 1989, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities*, OSW.

<sup>33</sup> American Society for Testing of Materials (ASTM), 1998, *Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs* D6317

establish pre-mining groundwater quality is applicable only if the data are from a normal or lognormal distribution. GCGCD commented that UEC did not perform a valid statistical test to demonstrate whether the groundwater quality data were characterized by either a normal or lognormal distribution. GCGCD advocated use of the Shapiro-Wilk Test, performed at a type 1 error rate of 0.05 to determine whether or not UEC's groundwater data could be characterized as normally- or lognormally-distributed. GCGCD emphasized that when data cannot be characterized as being either normally- or lognormally distributed, use of the mean or standard deviation are meaningless, as these two parameters are defined only for a normal or lognormal distribution.

#### **Response 25**

The Executive Director agrees that UEC did not evaluate the baseline data for normality, and agrees that use of the Shapiro-Wilk tests at a type I error rate of 0.05 is an acceptable method on which to base a decision as to the normality or lognormality of a data set. However, a determination of normality is necessary when a parametric statistical test is used that requires the data to be normally distributed (such as the student t-test, a parametric tolerance interval, or a parametric prediction interval).

With regards to data for which normality and lognormality can be rejected based on the Shapiro-Wilk Test, the Executive Director does not agree that in this case use of the mean or standard deviation is meaningless. Any continuous distribution has a true mean and a true standard deviation,<sup>34</sup> and the value of each of these parameters can be estimated using the statistical estimators  $\bar{x}$  and  $s$ , respectively. The fact that a distribution is not defined by  $\mu$  or  $\sigma$  (or both), as are the normal and two-parameter lognormal distribution, is not an indication that the distribution has no true mean or true standard deviation.

#### **Comment 26**

GCGCD commented that data for which normality and lognormality can be rejected based on the Shapiro-Wilk Test must be analyzed using nonparametric statistical techniques, and advocated methods based on the median or on the interquartile range (IQR), as the median and IQR are better indicators of the distribution in a non-normal, asymmetric distribution, as they are influenced by extreme values to a lesser degree than the mean and standard deviation.

#### **Response 26**

The Executive Director agrees that data for which normality or lognormality has been rejected are best analyzed using nonparametric hypothesis tests. However, the Executive Director does not agree that use of the sample mean or IQR is necessary when normality and lognormality of the data are rejected based on the Shapiro-Wilk Test. The Executive Director notes that the two methods mentioned by GCGCD, the interquartile range and the median,<sup>35</sup> are statistical estimators, not hypothesis tests. A comparison of future sample medians or IQRs each would represent a hypothesis test, just as comparison of future estimates of the mean to the pre-mining mean is an hypothesis test.

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<sup>34</sup> The standard deviation of a distribution is equal to the square root of the variance.

<sup>35</sup> The interquartile range is used to estimate the spread in a distribution, and the median is used to measure central tendency of a distribution.

#### Comment 27

Based on GCGCD's own evaluation, GCGCD commented that because UEC did not use valid statistical methods, did not provide completion reports for all baseline wells, did not discuss well development, used improper screen intervals, and used an insufficient number of samples, there is not a valid data set from the OMW wells, which are for monitoring the overlying Sand A, for the BMW wells, which are for monitoring Sand B, the production zone, or for the PTW and RBLB wells, which are for baseline determination. Therefore, according to GCGCD, any statistical calculations done using these data will provide invalid results.

For the purpose of demonstrating, proper statistical methods, GCGCD evaluated the distributional characteristics of the BMW well data, noting however that the results have not scientific validity due to the deficiencies noted in the preceding paragraph.

Using the Shapiro-Wilk Test,<sup>36</sup> GCGCD evaluated the groundwater data for 22 of the 26 constituents from the production zone monitor wells (the BMW wells) for distributional characteristics. For each constituent, GCGCD calculated a p-value<sup>37</sup> both for the original data and for the log-transformed data. The following methodology was used by GCGCD to evaluate the distributional characteristics for each constituent data set:

P-value for original data set is greater than 0.05 and p-value for log-transformed data set is less than 0.05—data are assumed to be from a normal distribution;

P-value for original data set is less than 0.05 and p-value for log-transformed data set is greater than 0.05—data are assumed to be from a lognormal distribution;

P-value for both the original and log-transformed data sets is greater than 0.05, but p-value for original data set is greater than p-value for log-transformed data set—data are assumed to be from a normal distribution;

P-value for both the original and log-transformed data sets is greater than 0.05, but p-value for original data set is less than p-value for log-transformed data set—data are assumed to be from a lognormal distribution;

P-value for both the original and log-transformed data sets is less than 0.05—data are assumed to be from neither a normal or lognormal distribution

GCGCD concluded that the data for calcium, magnesium, sulfate, chloride, and total dissolved solids each could be characterized as being from a normal distribution, and sodium bicarbonate, manganese, and uranium each could be characterized as being from

<sup>36</sup> EPA, 1992, *Statistical Analysis of Ground-water Monitoring Data at RCRA Facilities*, Draft Addendum to Interim Final Guidance, pages 9-12.

<sup>37</sup> The p-value is the smallest level of significance at which the null hypothesis would be rejected when a specified test procedure is used on a given data set (*Probability and Statistics for Engineers*, 1987, Devore, J. I., 2<sup>nd</sup> ed., Brooks/Cole Publishing Co., Monterey, CA.)

a lognormal distribution. GCGCD concluded that potassium fluoride, silica, pH, arsenic, cadmium, iron, lead, mercury, molybdenum, selenium, and radium-226 each could not be characterized as being from a normal or lognormal distribution, and that the distributional characteristics of nitrate could not be evaluated due to a majority of the analyses for nitrate being below the detection limit for nitrate.

GCGCD compared their results<sup>38</sup> to the averages calculated by UEC for these 22 constituents,<sup>39</sup> and concluded that there are significant differences between UEC's averages and the values determined by GCGCD for the following constituents: iron, molybdenum, and radium. In each case, GCGCD's values were lower than the averages calculated by UEC. GCGCD stated that because the values for iron and molybdenum are relatively low, and because there are no primary drinking water standards for these two constituents, these differences, the use of UEC's values, although invalid in GCGCD's opinion, poses no significant decision problems. With regard to radium-226, however, GCGCD emphasized that their value, 2.7 pCi/l was significantly lower than UEC's average of 12.1 pCi/l. GCGCD further emphasized that the primary drinking water standard for radium-226 is 5 pCi/l; therefore, based on their value of 2.7 pCi/l, the groundwater at the monitor well ring meets the primary drinking water standard, and its class of use must be defined as suitable for human consumption.

GCGCD stated that when data cannot be characterized as being either normally or lognormally distributed, estimates of the mean and standard deviation based on those data are meaningless because these distributional parameters are defined ONLY (emphasis GCGCD) for a normal or lognormal distribution.

#### **Response 27**

As discussed in Response 15, the Executive Director considers the data from the monitor and baseline wells to be valid. With regards to GCGCD's demonstration of the use of proper statistical methods, the Executive Director agrees that the Shapiro-Wilk Test is an excellent test for making a decision to accept or reject that a data set is from a population that is normally or lognormally distributed, and recognizes this test is recommended by the EPA.<sup>40</sup> Such a determination is necessary because when performing an hypothesis test, certain statistical methods require the sample data to be from a normal distribution (such as the student t-test or the combined cumulative sum control chart).

The Executive Director does not agree that the estimated mean value of 2.7 pCi/l for radium-226 indicates the groundwater in all 22 monitor wells is suitable for human consumption. Although this value is below the primary drinking water standard for radium-226, the Executive Director considers the use of the lower estimated median value to characterize this groundwater to be less conservative than using the higher estimated mean value of 12.1 pCi/l, when making a decision regarding the suitability of water for human consumption.

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<sup>38</sup> Table 2, July 10, 2009 comment letter from GCGCD to TCEQ.

<sup>39</sup> UEC PAA1 application, Table 5.3, page 5-14.

<sup>40</sup> EPA, 1992, *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities*, Draft Addendum to Interim Final Guidance, Office of Solid Waste, page 9.

**Comment 28**

GCGCD noted that the data initially used to construct the restoration table contains discrepancies. Because of these discrepancies, GCGCD has requested that a new series of groundwater samples be collected and analyzed, and that both the GCGCD and the TCEQ participate in this sampling. GCGCD gave the following concerns and questions for this request:

1. What was the impact on water quality as a result of the drilling and delayed plugging of numerous exploration boreholes?
2. Are the test well screens properly positioned to provide a representative water sample of the aquifer?
3. Was the well adequately purged prior to taking of the water sample?
4. Why do the tests from the first group of ten wells show values for uranium and radium-226 so much lower than the values of the eight wells drilled several months later? Is there oxidizing occurring?
5. What is the correct baseline for restoration?

**Response 28**

The Executive Director assumes the data discrepancies referenced by GCGCD refer to the inclusion of the groundwater analysis data from well PTW-7 being inadvertently included twice in the estimation of the means for the parameters included in the proposed restoration table. This issue was discussed in Response 8 and has been corrected. The draft PAA has been revised.

As discussed in previous responses, the Executive Director considers the groundwater sample analysis data to be valid, and does not agree that these data should be discarded and replaced with new data. As discussed in the responses under the heading "Degradation of Water Quality During the Exploration Phase" below, the Executive Director finds no evidence that groundwater quality in the area was affected by exploration drilling. The Executive Director understands that the RRC investigated concerns that UEC had left boreholes unplugged, and that the matter was resolved to the satisfaction of the RRC. Suitability of well screen length was discussed in Response 15. Well development was discussed in Response 18, and the Executive Director considers UEC's well development methods to be acceptable. The differences in groundwater sample analyses between the two groups of wells were discussed in Response 15. The restoration values proposed by UEC, which are based on data from the 18 baseline wells, is acceptable to the Executive Director. Therefore, the Executive Director does not agree that additional well sampling is needed and finds that UEC's methods are adequate and comply with the applicable rules.

**E. ECONOMIC IMPACTS ON QUALITY OF LIFE****Comment 29**

Thomas and Mary Anklam commented that the Boer goats they raise and sell for profit have decreased in value due to exploration activities. The Bettges commented that reduced water quality and quantity will adversely effect their water resources, resulting in



economic issues as well as health issues. Also, the Bettges commented that any contamination of their underground water supply or the environment, or any perception of such contamination, will reduce the market value of their land. Monica Diaz Black commented that mining in this area would be terrible for tourism, and that people would not want to move to Goliad County to live.

#### **Response 29**

UEC analyzed a sample of groundwater from the Anklam's water well and provided the results in Table 5.1 of the application for Class III injection well area permit. The results of this analysis indicate that at the time this well was sampled, water from the Anklam's well met primary drinking water standards for inorganic constituents identified in 30 TAC Chapter 290, Subchapter F.<sup>41</sup> The Executive Director regrets that public fears regarding the proposed activity may be affecting the price the Anklam's livestock and their business. Such perceptions are not consistent with the history of *in situ* uranium mining in South Texas. Nevertheless, the proposed production area authorization does not authorize UEC to cause economic injury. The rules and the draft area permit specifically provide that the permit does not authorize any injury to persons or property or an invasion of other property rights, or infringement of state and local law or regulations, but the TCEQ does not have jurisdiction over the award of civil damages from injury to persons or property.

#### **Comment 30**

Larrie and Brenda Brysch emphasized that they depended on groundwater for their livelihood as ranchers. Ted Long stated that depletion of the aquifer will cause severe economic hardship as well as quality of life hardships for landowners in the area, and asked how UEC plans to compensate landowners for loss of their groundwater and reduced property values.

#### **Response 30**

The TCEQ does not regulate the use of groundwater. The TCEQ's injection well permit rules and the draft PAA impose no limits on the amount of groundwater a landowner is allowed to pump from his or her wells. The TCEQ's jurisdiction is established by the legislature and is limited to the issues set forth in statute. Accordingly, the TCEQ does not have jurisdiction to consider the effects on property values when determining whether to approve or deny a PAA application. The rules and the draft Class III injection well area permit specifically provide that the permit does not authorize any injury to persons or property or an invasion of other property rights, or infringement of state and local law or regulations.

#### **Comment 31**

Brenda Jo Hardt commented that the TCEQ must consider the water needs of existing industries, and asked how the TCEQ can justify economic development of uranium and at the same time ruin the agricultural use of land and clean water. Ms. Hardt noted that

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<sup>41</sup> The Executive Director notes that these standards apply to public drinking water systems. Private water wells are not regulated by the TCEQ.

UEC has stated they will employ about 80 people, but emphasized the greater economic impact from agriculture.

**Response 31**

The TCEQ does not regulate the use of groundwater and does not favor one industry over another with regard to water use in the consideration of an application for a PAA. In accordance with its mission statement, the TCEQ "strives to protect our state's human and natural resources consistent with sustainable economic development. Our goal is clean air, clean water, and the safe management of waste." Towards that goal, the Texas Legislature has adopted statutes such as the Texas Injection Well Act to protect the state's groundwater resources. Accordingly, the Executive Director reviewed the application for the PAA under the applicable statutes and rules. The Executive Director is not aware of any cases where *in situ* uranium mining in South Texas adversely affected the local agricultural economy.

**Comment 32**

Ted Long commented that he intends to raise fish on his property, which is near the UEC site. He asked if he will be able to do this if mining results in damage to the aquifer.

**Response 32**

The Executive Director does not expect there to be contamination of groundwater outside the boundaries of the proposed permit area that would affect the groundwater beneath offsite property. The Executive Director's review of UEC's application for a PAA indicates operation of the *in situ* uranium mine in the area proposed for PAA1 meets all applicable regulatory requirements, which provide adequate safeguards to prevent offsite contamination of groundwater. The rules and the draft area permit specifically provide that the permit does not authorize any injury to persons or property or an invasion of other property rights, or infringement of state and local law or regulations.

**Comment 33**

Ted Long asked if mining operations will affect hunting, fishing, and other recreational activities near the mining site.

**Response 33**

The Executive Director does not expect that mining operations will affect hunting, fishing and other recreational activities outside of the proposed permitted area.

**Comment 34**

Ted Long asked if UEC expected county taxpayers to bear the increased costs needed for law enforcement and emergency personnel due to the increased industrial activity in the area.

**Response 34**

The Executive Director is unaware of any intentions UEC may have in this matter. The application for PAA1 did not address the county's funding of law enforcement and

emergency planning, and the applicable rules for PAA application do not specify any requirements for reimbursement of local law enforcement or emergency services.

#### **Comment 35**

Wayne and Margie Smith commented that they went to the expense of testing the water in their well, and that they will have to do this periodically to determine if it is contaminated. They stated this is an expense they cannot afford, and said that UEC should bear these costs.

#### **Response 35**

The TCEQ injection well rules and proposed draft permit do not require an offsite water well owner to test his or her own water well. Private water wells are not regulated by the TCEQ and any decision as to testing frequency is the decision and responsibility of the well owner. If UEC is granted authorization to conduct *in situ* mining operations at this site, UEC will be required to meet all regulatory requirements for *in situ* mining of uranium. These requirements include operating the wells in a manner than confines the mining fluids to the production zone within the area of the designated monitor wells, monitoring of the production zone and overlying fresh water zones, aquifer restoration, and plugging and abandonment of wells. These requirements are designed to protect the groundwater quality in the vicinity of the mining operations.

### **F. GROUNDWATER QUALITY**

#### **Comment 36**

Judy Lenamon expressed concern about protecting the environment from the harmful affects of uranium mining, especially effects to the groundwater. Mina Williams commented that she is concerned about the effects of *in situ* mining on the aquifer, as she owns a small ranch in Live Oak County where extensive uranium mining was done in the past, and where active exploration is occurring. She also expressed concern that mining on property near hers could have a negative effect on the groundwater beneath her property, as contamination of groundwater at the mine site could migrate onto her property. Ted Long stated there is no horizontal confinement of the aquifer, and after mining, groundwater from the mined zone will comingle with surrounding water, thereby reducing the water quality unless stringent water quality standards are enforced.

#### **Response 36**

Natural geologic conditions and operating procedures, both discussed below, will protect the environment from any effects associated with the operation of Class III injection wells. If UEC receives all the necessary authorizations to conduct *in situ* uranium mining at the site, they are required to confine mining solutions within the designated production zone monitor wells. Migration of mining fluids is controlled through the spacing of injection and recovery wells, and by pumping more groundwater than is injected (known as "bleed.") This results in the movement of groundwater from the injection wells toward the production wells, keeping these fluids within the production area. Sand B, which is the sand UEC proposes to mine in Production Area 1, occurs as a continuous sheet across the proposed production area, and is overlain and underlain by continuous

shale units.<sup>42</sup> Furthermore, the results of hydrologic tests<sup>43</sup> indicate hydraulic connection in Sand B from the production area outward to the monitor well ring. Also, these tests indicated that Sand B is not hydraulically connected to either overlying Sand A or underlying Sand C. These features will aid in confining the mining solutions to Sand B within the production area. Because Sand B occurs as a continuous sheet rather than in discrete channels, any migration of mining fluids from the production area would be intercepted by the monitor wells completed in Sand B.

The oxidizing nature of the injected mining fluids results in uranium and other constituents being dissolved from Sand B. After mining is complete, the oxidizing environment created in Sand B within the production area remains. Aquifer restoration will lower the level of oxidation within the mined portion of Sand B, but oxidizing conditions may persist to some degree. Under these oxidizing conditions, certain constituents can occur in higher concentrations in the groundwater. However, outward from the mined portion of Sand B, reducing conditions will prevail. As groundwater migrates from the mined portion of Sand B, it will encounter these reducing conditions, and the concentrations of the constituents dissolved in the groundwater will be reduced to background concentrations.

Finally, Sand B and overlying Sand A will be monitored to detect the migration of any mining fluids from Sand B within the production area. If mining fluids are detected in any of these wells, UEC must, in accordance with the requirements of 30 TAC §331.106 (Relating to Remedial Action for Excursion), take actions to confine the mining fluids to Sand B within the production area. Possible actions that might be taken include increasing the amount of bleed water, or the installation of additional production wells in the area of the excursion. The purpose of both these actions, either separately or together, is to induce groundwater to flow towards the production area, rather than outwards from it. Once mining is complete, the aquifer must be restored in accordance with the requirements of 30 TAC §331.107 (Relating to Restoration).

#### **Comment 37**

GCGCD commented that they, the TCEQ, and UEC have statutory responsibility to protect the drinking water for local users, and that they do not recognize where UEC's application has seriously addressed this requirement. Mr. and Ms. Gary Blanton emphasized the importance of water. Raymond and Karon Arnold commented that because of their proximity of his property to the UEC site, they are concerned about the probability that mining operations will result in contamination of their water supply. Wayne and Margie Smith expressed similar concerns. Richard and Catherine Bettge expressed concern that their four water wells could become contaminated by comingling of high quality groundwater from the Evangeline Aquifer with lower quality groundwater from deeper sands, as well as from contamination from mining and aquifer restoration activities. The Bettges noted that their wells are completed in the same aquifer that will be mined. They expressed the opinion that groundwater can move horizontally from the

<sup>42</sup> UEC PAA1 application, Section 3.0-Production Area Geology and Hydrogeology, and cross sections A-A', B-B', C-C', D-D', and e-e'.

<sup>43</sup> UEC PAA1 application, Section 4.0-Hydrologic Testing

mining site to their wells. Lastly, they stated that the water quality resulting from mining and aquifer restoration will be harmful to their health and to the health of their livestock. G. A. Gutmann expressed the opinion that groundwater contamination from exploration drilling by UEC can result in loss of jobs, property, and even life, and that it is the TCEQ's responsibility to protect citizens from these losses. Patrick and Denise Lovett commented that they live and ranch in this area and are concerned about the contamination of their dwindling water supply. Weldon Scott Orr expressed concern about his family's well-being if groundwater is contaminated with uranium, radium-226, radon-222, molybdenum, selenium, cadmium and arsenic by *in situ* mining activities. Mr. and Mrs. Manfred Scheurich stated they are concerned that *in situ* uranium mining could have far-reaching negative implications for the groundwater of the Gulf Coast Aquifer. Gene and Reta Brown commented that they depend on their wells for domestic and agricultural use. The Brown's also commented that their wells have been affected by iron bacteria contamination, which they had never experienced prior to UEC's exploration drilling at the site. Brenda Jo Hardt commented that the proposed mining operation will permanently affect the quality of the aquifer. Ted Long commented that the *in situ* mining process results in compounds being dissolved from the aquifer material into the groundwater, and that these compounds could migrate from the production area and pollute private water wells in the vicinity. Joan Fabian, Jacqueline Fonseca, Carol Fulton, Veronica Galvan, Cheri Hart, Donna Hoffman, Lois Huff, Kenneth Izumi, Steven G. Kellman, Barbara Allen-Lampley, Judy Landress, Philip LeMessurier, Kathy B. Newman, Wayne Owens, Catherine Schneider, Ed Sonnen, Mark Sprinkle, Rebecca Sprinkle, Ryan Sprinkle, Mobi Warren, Kelli Wilder, and Paul Fitzpatrick requested that the TCEQ deny UEC's application for PAA1 because groundwater that has been used and currently is being used in northern Goliad County domestically and for agriculture will be contaminated and never cleaned up if UEC is allowed to conduct *in situ* mining operations in this area.

### Response 37

The Executive Director acknowledges the concerns raised by Goliad County residents regarding groundwater contamination that could result from *in situ* mining for uranium in Sand B within the proposed production area. If the Class III injection well area permit and the PAA are issued, UEC must meet all applicable regulatory requirements to conduct *in situ* mining operations. The focus of these requirements in 30 TAC Chapter 331 and the Underground Injection Control Program, in general, is to protect underground sources of drinking water and fresh water from pollution.

The *in situ* process involves injecting a mining fluid into a mineralized zone, circulating this fluid through the zone to dissolve uranium minerals from the aquifer material, and then pumping the mining fluid to the surface where it can be processed to recover uranium. In addition to uranium, other constituents, such as arsenic, molybdenum, and radium-226, may also be dissolved from the aquifer material into the mining fluid. This results in an increase in the concentration of certain constituents in the groundwater in the mineralized zone within the area to be mined. To provide protection of groundwater outside of the zone and area being mined using *in situ* techniques, the permittee must, in accordance with the requirements of 30 TAC §331.102, confine the mining solutions to

the production zone within the area production zone monitor wells. To ensure protection of the areas outside of the mining area, the applicant/permittee must:

- Identify existing wells that could serve as a conduit for mining solutions to move outside the production zone or the production area (30 TAC §331.42);
- Construct wells in accordance with proper construction requirements (30 TAC §331.82);
- Maintain mechanical integrity of all Class III wells (30 TAC §331.4);
- Implement corrective action standards to prevent or correct pollution of a USDW (30 TAC §331.44);
- Obtain Executive Director approval of construction and completion of wells (30 TAC §331.45);
- Operate wells in accordance with proper operation requirements (30 TAC §331.83);
- Monitor wells in accordance with monitoring requirements (30 TAC §331.84);
- Submit reports in accordance with reporting requirements (30 TAC §331.85); and
- Close wells in accordance with a plugging and abandonment plan in a manner that will not allow the movement of fluids through the well, out of the injection zone, or to the land surface (30 TAC §§331.46 and 331.86);

Additionally, in order to conduct *in situ* mining activities, UEC will need a Class III injection well area permit and a production area authorization for each production area to be mined within the permitted area. When making a decision to issue or deny a request for a Class III well area permit, the Executive Director takes into consideration all the factors detailed in 30 TAC §331.122:

- All injection wells, dry holes, surface water bodies, quarries, public water systems, private water wells, and faults in the area of review;<sup>44</sup>
- All data reasonably available on all wells in the area of review;
- Vertical and lateral limits of USDWs in the area of review
- Maps and cross sections illustrating regional geology;
- Proposed operating data;
- Proposed formation testing program;
- Proposed stimulation program;
- Proposed operation and injection procedure;
- Engineering drawings of surface and subsurface construction details of the system;
- Plans for meeting minimum monitoring requirements;
- Expected changes in pressure, fluid displacement, direction of movement of injected fluid;
- Contingency plans to cope with all shut-ins or well failures;
- Corrective action procedures;

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<sup>44</sup> For a Class III injection well area permit, the "area of review" is the project area plus a circumscribing area the width of which is either ¼ mile or a number calculated according to the criteria set forth in 30 TAC §331.42.

- Adequacy of financial assurance;
- Closure plan; and
- Other information reasonably required by the executive director.

Before mining can begin, UEC must obtain a Production Area Authorization (PAA) from the TCEQ.<sup>45</sup> A PAA is a document, issued under the terms of an injection well permit, approving the initiation of mining activities in a specified production area within a larger permit area.<sup>46</sup> A PAA contains localized restoration and monitoring requirements for a particular production area.<sup>47</sup> The PAA requires mining solutions to be confined in the production zone within the area of designated production zone monitoring wells.<sup>48</sup> When a person or company submits an application for a PAA, the application must address:

- Confinement of mining fluids (30 TAC §331.102);
- Production area monitor wells (30 TAC §331.103);
- Establishment of Baseline and Control Parameters for Excursion Detection (30 TAC §331.104);
- Monitoring Standards (30 TAC §331.105);
- Remedial Action for Excursion (30 TAC §331.106); and
- Restoration (30 TAC §331.107).

In addition to requirements of the rules, if the permit is issued, it will require the permittee to ensure that no mining fluids are leaving the production zone by regularly testing groundwater samples from monitor wells. The draft permit requires the permittee to take water samples at least twice each month at two-week intervals from all monitor wells and analyze these samples for control parameters<sup>49</sup> specified in the draft PAA.<sup>50</sup> The draft permit also contains provisions to ensure samples are taken, preserved, and analyzed in a manner that will yield valid results.<sup>51</sup> If an excursion is detected, monitoring frequency must increase.<sup>52</sup> By complying with monitoring requirements, the applicant can ensure that there are no excursions that contaminate water outside the production zone within the production area. If an excursion is detected, it will be promptly detected, enabling the applicant to take immediate action to stop the excursion, as required by rules.<sup>53</sup>

Protection of groundwater quality is the most significant concern in regulating *in situ* mining, but there is never a 100% guarantee that any activity will not adversely affect the environment. The rules cited above were adopted to protect underground sources of drinking water and fresh water in the state and the proposed permit and PAA contain

<sup>45</sup> UEC Draft Class III Injection Well Are Permit, Section V.A.

<sup>46</sup> 30 TAC §331.2(75).

<sup>47</sup> 30 TAC Ch. 331, Subchapter F (§§ 331.101 et. seq.)

<sup>48</sup> UEC Draft Class III Injection Well Are Permit, Section V.F.

<sup>49</sup> 30 TAC §331.105.

<sup>50</sup> UEC Draft PAA1, Section III.D.

<sup>51</sup> UEC Draft Permit, Section V.F.

<sup>52</sup> UEC Draft Permit, Section V.G.2.

<sup>53</sup> 30 TAC §331.106

requirements to ensure that mining fluids will not contaminate water off-site. The Executive Director is not aware of a documented case in over 30 years of *in situ* mining of off-site groundwater contamination from *in situ* uranium mining in South Texas.

#### **Comment 38**

John and Pearl Caldwell expressed opposition to issuance of the proposed PAA because of contamination of their groundwater (discoloration) due to exploration drilling at the site by UEC. Ted Long commented that several landowners have experienced iron bacteria contamination in their wells, and have had to buy drinking water, water softeners, and filtration systems. Mr. Long asked why these landowners are responsible for these expenses when they are not involved with the uranium mining project. He also expressed the concern that the iron bacteria may be harmful to livestock and wildlife.

#### **Response 38**

The Executive Director is aware that several landowners in the vicinity of the UEC site have iron bacteria contamination in their wells. The presence of active iron bacteria results in additional iron being dissolved into the groundwater, the development of mucilaginous sheaths of bacteria ("slimes"), and the precipitation of iron hydroxides. Dissolved iron gives the water a red color and an iron taste, and stains porcelain fixtures such as sinks and tubs; the slimes clog water filters, and the precipitation of iron hydroxide can block water pipes. The Executive Director is not aware that iron bacteria presents a health hazard to livestock or to wildlife.

The drilling of exploration wells at this site is authorized by a permit from the Railroad Commission (RRC). The Executive Director understands that the RRC has investigated public concerns regarding exploratory drilling, and found no evidence that iron bacteria problems in local wells were associated with exploration drilling.

#### **Comment 39**

Powell Calhoun with the Goliad County Farm Bureau expressed concern regarding uranium daughter products in the groundwater. Because they cannot be mined economically and will therefore remain in the groundwater, Mr. Powell expressed concern about the effects of these constituents on livestock and wildlife from long-term exposure to these daughter products by drinking the affected water and from eating foliage irrigated with the affected water. Mr. Powell also expressed concern that this exposure could result in genetic effects on livestock and wildlife.

#### **Response 39**

The one uranium daughter product included in the suite of constituents for which UEC is required to restore groundwater to pre-mining conditions is radium-226, a daughter product from the radioactive decay of uranium-238. The Executive Director notes that based on the analysis of groundwater samples collected from the mineralized portion of Sand B within the proposed production area, the naturally-occurring levels of radioactivity from radium-226 in this groundwater ranges from 10 to 1684 picocuries per liter (pCi/l).<sup>54</sup> These values exceed the primary drinking water standard of 5 pCi/l.<sup>55</sup>

<sup>54</sup> IIRC PAA1 application Table 5.2



which is the maximum level for public drinking water systems. Additionally, although the state regulations do not contain water quality standards for livestock or wildlife, the Executive Director notes that the National Academy of Science recommends a limit of 5 pCi/l for livestock and irrigation.<sup>56</sup> Therefore, the naturally-occurring quality of the groundwater in Sand B within proposed Production Area 1 is not suitable for human consumption, and most likely would be inappropriate for consumption by livestock or wildlife or for use in irrigation.

If UEC obtains authorization to conduct *in situ* mining operations at this site, UEC will be required to conduct aquifer restoration in accordance with the requirements of 30 TAC § 331.107.

#### **Comment 40**

GCGCD commented that on page 5-8 of UEC's application, UEC stated that the 22 production zone monitor wells obviously do not meet EPA Drinking Water Standards. GCGCD noted that the data from these wells has significant variability, with the western wells exhibiting significantly better water quality than that from the eastern wells, especially with respect to uranium. GCGCD stated that this situation should raise a concern that migration is indicated, which can impact monitoring requirements and restoration values.

#### **Response 40**

The Executive Director notes that the higher levels of radium-226 occurs in the groundwater samples collected from monitor wells BMW-1 through 5 and BMW-19 through 22, which are to the northeast and east of the proposed production area. When considered as a group, these results indicate the groundwater in this area exceeds the primary drinking water standard for radium-226.<sup>57</sup> However, not all groundwater samples from the 22 monitor wells exceeded the primary drinking water for radium-226. The geophysical logs in Appendix C of the application indicate the wells with high radium-226 values have elevated gamma ray responses when compared to the geophysical logs for those wells with lower radium-226 values. The higher gamma ray response is an indication of uranium mineralization, rather than migration of radium-226 from the proposed production area.

The elevated radium (and in some wells, uranium) values in these wells will not affect monitoring for excursions, as neither radium nor uranium are designated indicator parameters. The two parameters for excursion detection are chlorides and conductivity.<sup>58</sup> Data from the groundwater samples collected from the 22 monitor wells indicate little

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<sup>55</sup> 30 TAC §290.104.

<sup>56</sup> Water Quality Criteria, 1972, a Report of the committee on Water Quality Criteria, Environmental Standards Board, National Academy of Sciences, National Academy of Engineers, EPA-R3-73-033.

<sup>57</sup> 5.0 pCi/l, 30 TAC § 290.108

<sup>58</sup> UEC PAA1 application, Table 6.5.

variation in either of these parameters.<sup>59</sup> Restoration values for uranium and radium-226 are determined from baseline wells, not monitor wells.<sup>60</sup>

#### **Comment 41**

GCGCD expressed concern regarding the migration of contaminated groundwater. GCGCD noted that in paragraph 5-3 on page 5-15 of the application UEC states the monitor well average for radium-226 as 12 pCi/l.<sup>61</sup> GCGCD emphasized, however, that nine of the wells in the eastern part of the proposed production area have an average radium-226 radioactivity of 26.5 pCi/l, whereas 13 wells in the western part have an average radium-226 radioactivity that is within drinking water standards.

#### **Response 41**

As discussed in Response 40 the gamma ray response in the geophysical logs of the 22 monitor wells indicate the higher values for radium-226 in the monitor wells to the northeast and east of the proposed production area is due to uranium mineralization, not migration of radium-226 from the proposed production area.

#### **Comment 42**

GCGCD commented that a large change from historic use of water in the recharge area of the Evangeline Aquifer may have the effect of perturbing the aquifer and creating significant water quality issues.

#### **Response 42**

Based on the Mine Plan presented in Section 7.0 of the PAA1 application, UEC projects the ultimate disposal of 1,169 acre-feet of groundwater during the estimated eight years of operation (UEC's November 6, 2009 amendment to the application reflects a revised estimate of projected water consumption from 2,417 acre-feet to 1,169 acre-feet). The Executive Director does not anticipate that this amount of groundwater disposed over this length of time will significantly affect the aquifer level in this area. As will be further discussed in Responses 54 and 58, Sand B in the proposed production area is under confined conditions; recharge of the aquifer is not occurring within the proposed production area. Recharge of the Goliad Sands is occurring to the northwest of the site, where these sands sequentially crop out.

#### **Comment 43**

Ted Long asked if residents can reasonably expect the quality of groundwater in their wells to equal or exceed pre-mining groundwater quality once mining is complete.

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<sup>59</sup> Chloride values range from 158 to 172 mg/l, with a standard deviation of 4 mg/l, and conductivity values range from 1040 to 1140 µmhos/cm with a standard deviation of 29 µmhos/cm; see Table 5.3 of UEC's PAA1 application.

<sup>60</sup> 30 TAC §335.104(e).

<sup>61</sup> "pCi/l" is an abbreviation for "picocuries per liter". Curies are a measure of radiation. One curie is equal to the radiation emitted by one gram of radium, or  $3 \times 10^{10}$  disintegrations per second. A picocurie is one-trillionth of a curie.

#### Response 43

The Executive Director expects that groundwater in private wells outside of the permitted area will not be affected by the mining operations. If UEC obtains all of the authorizations needed to conduct *in situ* uranium mining at this site, actual mining would be authorized only within production areas authorized under a PAA, and only with an area for which an aquifer exemption has been approved. For PAA1, mining would be limited to Sand B within the production area. UEC is not required to establish pre-mining groundwater quality in private wells in the vicinity of the site for the PAA application, although it has provided some information in the Class III area permit application.<sup>62</sup> If UEC's mining activities resulted in the contamination of a private water well, UEC would be subject to a TCEQ enforcement action, under which it would be required to remediate any contamination it caused.

#### Comment 44

GCGCD requested that the TCEQ provide a thorough technical evaluation to identify the quality of all contiguous groundwater, to ensure that the current integrity of all groundwater is maintained, and to guarantee that there will be no injury to property or invasion of other property rights. Lynn and Ginger Cook supported this request.

#### Response 44

UEC has provided sufficient data to characterize the groundwater quality in the area to the extent required for evaluation of their Class III injection well area permit and PAA1 applications. The data includes groundwater analysis data from 50 private wells and 20 initial baseline wells in the Class III injection well area permit, and 22 production zone monitor wells, 14 additional baseline wells in Sand B, and 9 monitor wells in Sand A in the PAA1 application.

The Executive Director cannot guarantee there will be no injury to property or invasion of property rights from UEC's mining operation, but emphasizes the draft Class III injection well area permit specifically provides that the permit does not authorize any injury to persons or property or an invasion of other property rights, or any infringement of state or local law or regulations. The permittee may be subject to civil liability for damages caused to residents or landowners.

### G. GROUNDWATER QUANTITY/AVAILABILITY

#### Comment 45

Joan Fabian, Jacqueline Fonseca, Carol Fulton, Veronica Galvan, Cheri Hart, Donna Hoffman, Lois Huff, Kenneth Izumi, Steven G. Kellman, Barbara Allen-Lampley, Judy Landress, Philip LeMessurier, Kathy B. Newman, Wayne Owens, Catherine Schneider, Ed Sonnen, Mark Sprinkle, Rebecca Sprinkle, Ryan Sprinkle, Mobi Warren, Kelli Wilder, and Paul Fitzpatrick requested that the TCEQ deny UEC's application for PAA1 because *in situ* mining for uranium requires the use of huge quantities of groundwater. Ray and Kathy Albrecht commented that UEC should be required to justify the extreme number of wells that will be required for *in situ* mining, as well as the large amount of

<sup>62</sup> UEC Class III UIC area permit, Section 5.0.

water required for production will not affect the quality and quantity of their drinking water. Larrie and Brenda Brysch commented that water shortages are occurring because of the drought, and that UEC has not addressed this situation. The Brysch's suggested that UEC be required to curtail mining operations during periods of extreme drought. Richard Bettge commented that drawdown should be monitored to avoid depletion of the shallow water sands. Gene and Reta Brown expressed the concern that water use at the proposed mining operation would cause their well to go dry. Wayne and Margie Smith expressed concern about the lowering of water levels in the area due to mining.

#### **Response 45**

The TCEQ rules that govern an injection well area permit and the requirements for a PAA do not limit the number of wells that can be drilled within a permitted area. Under 30 TAC §331.7(b) (Relating to Permit Required), an area permit that authorizes more than one well may be issued for a defined permit area in which wells of similar design and operation are proposed, provided all wells are operated by a single owner or operator.

Injection well requirements that apply to *in situ* mining do not limit the volume of fresh water used by a permittee to conduct *in situ* mining operations, either during a drought or under other climatic conditions.

The draft permit specifically provides that the permit does not authorize any injury to persons or property or an invasion of other property rights, or any infringement of state or local law or regulations. The permittee may be subject to civil liability for damages caused to residents or landowners. The TCEQ does not have jurisdiction over the award of civil damages from injury to persons or property.

#### **Comment 46**

Raymond and Karon Arnold commented that they are concerned that the excessive amount of water needed for *in situ* mining and aquifer restoration will deplete the aquifer. They stated that the Abitz and Blandford studies indicate a potential drawdown of 40 to 70 feet ½ mile from the site, which would effectively dry up his water wells. Richard and Catherine Bettge commented that mining and restoration activities may reduce the quantity of water available from their four wells, forcing them to drill deeper wells for water of lesser quality, which will require higher pumping costs. The Bettge's commented that alternatively, they may have to purchase water for themselves and their livestock. Monica Diaz Black expressed concern that mining would result in the depletion of natural resources. Powell Calhoun for the Goliad County Farm Bureau commented that the amount of water that will be disposed at the proposed mining site (approximately 73,000 gallons according to Mr. Calhoun) is excessive, especially under the current drought. Ronnie Primrose commented that *in situ* uranium mining will require the use of millions of gallons of water from the aquifer that is their only source of drinking water. Cyrus Reed of the Lone Star Chapter of the Sierra Club commented that members of this organization are concerned about the enormous amounts of groundwater required for *in situ* uranium mining. Mr. and Mrs. Manfred Scheurich expressed concern that *in situ* mining will require extravagant expenditures of scarce and limited groundwater. David and Carol Warren commented that *in situ* mining requires millions

of gallons of water, and that South Texas does not have that amount of water to waste. Ted Long commented that excessive pumping for mining and clean up probably will deplete the shallow sands in the Evangeline Aquifer. Mr. Long asked if mining would result in a lowering of the water table to the point owners of private wells in the area will have to drill deeper wells. He also stated that as mining activities expand and larger amounts of groundwater are used, water levels will be affected. Weldon Scott Orr expressed concern that *in situ* mining by UEC in this area will have a negative effect on available water supplies, both for groundwater and surface water.

#### **Response 46**

The TCEQ does not regulate or limit the use of groundwater. Under Texas law in Texas Water Code §36.0015, groundwater conservation districts created under Chapter 36 of the Texas Water Code are the state's preferred method of groundwater management through rules developed, adopted and promulgated by a district in accordance with Chapter 36. TCEQ's injection well requirements that apply to *in situ* mining do not limit the volume of groundwater used by a permittee to conduct *in situ* mining operations. Based on projections provided in Section 7.0 of the PAA application, UEC will dispose of about 1,169 acre-feet of water over the estimated eight year life of the operation (UEC's November 6, 2009 amendment to the application reflects a revised estimate of projected water consumption from 2417 acre-feet to 1169 acre-feet). This amount of water over this period of time should not result in an appreciable drawdown in the area adjacent to UEC's property. The Executive Director is not aware of any cases where *in situ* uranium mining in South Texas resulted in groundwater drawdowns in areas adjacent to a production area.

#### **Comment 47**

Raymond and Karon Arnold asked if UEC's PAA1 application contains a clause that would require the company to curtail or stop mining and cleanup operations if water levels in the UEC's wells or in neighboring wells fall to critical levels. The Arnolds also asked that if UEC is not currently required to curtail or stop mining and cleanup operations if water levels in wells drop to critical levels, whether the TCEQ will impose such a requirement on UEC. Brenda Jo Hardt requested the PAA be denied because mining will unreasonably reduce the amount of groundwater available for Goliad County.

#### **Response 47**

Neither the draft Class III injection well area permit nor the draft PAA1 include a provision that requires UEC to curtail or stop mining based on a drop in water levels within the aquifer. The TCEQ does not have authority to limit the amount of water produced by UEC, or any private well owner, for that matter. In both the Class III injection well area permit application and PAA1 application, UEC has provided the analysis of water use over the projected eight year life of the facility. Based on this analysis, the proposed mining will result in the disposal of about 1,169 acre-feet of water (UEC's November 6, 2009 amendment to the application reflects a revised estimate of projected water consumption from 2,417 acre-feet to 1,169 acre-feet). The withdrawal of this amount of water from the Goliad sands at the site over an eight year period should not result in an appreciable lowering of water levels in the area.

**Comment 48**

David and Carol Warren asked what can be done to decrease the amount of water wasted by mining.

**Response 48**

*In situ* uranium mining requires the use of large amounts of water. However, much of the water is reused in the mining process. The amount of water that ultimately is disposed at an *in situ* uranium mining operation is from bleed water and the brine that is generated from the reverse osmosis process. Improvements in the efficiency of the uranium extraction process and in reverse osmosis technology would decrease the amount of water ultimately disposed of at an *in situ* uranium mining operation.

**Comment 49**

GCGCD asked that given the projected water shortages in Texas, what is the value of the groundwater that is disposed in the deep injection wells.

**Response 49**

It is difficult to place a value on the water that will be disposed by deep well injection if UEC receives all the permits, licenses, and authorizations needed to conduct *in situ* uranium mining at this site. Groundwater presently in the production zone within the production area<sup>63</sup> is unsuitable for human consumption, and would be of questionable value for agricultural uses. The Executive Director notes that water rates posted by the Utilities Department of the City of Goliad<sup>64</sup> are \$4.50 per thousand gallons of water provided to a user outside the city limits for potable water that meets primary drinking water standards. The amount of water estimated to be disposed at the site is 1,169 acre-feet over a period of about eight years if all four projected PAAs are mined (UEC's November 6, 2009 amendment to the application reflects a revised estimate of projected water consumption from 2417 acre-feet to 1169 acre-feet).

**Comment 50**

GCGCD asked what the restoration requirements are for the area between the production area and the production zone monitor wells.

**Response 50**

Although *in situ* mining will not occur within the area between the edge of the production area and the monitor well ring, groundwater in this area could be affected by an excursion of mining fluids. All excursions must be addressed in accordance with the requirements of 30 TAC §331.106 (Relating to Remedial Action for Excursion). In the event of an excursion, the operator must first notify the TCEQ, and then complete a groundwater analysis report for each affected well. For wells affected by an excursion, the monitoring frequency is increased from twice a month to twice a week, and the list of monitoring

<sup>63</sup> The production area is that area defined by a line generally through the outer perimeter of injection and recovery wells used for mining (30 TAC §331.2(81)), whereas the mine area is defined by a line through the ring of monitor wells installed to monitor the production zone (30 TAC §331.2(62)). The production area lies within the mine area.

<sup>64</sup> See [http://www.goliadtx.net/docs/Service\\_Connection\\_Application.pdf](http://www.goliadtx.net/docs/Service_Connection_Application.pdf)

parameters is expanded to include, among other constituents, uranium and radium-226. An operator must clean up all excursions. Well clean-up is deemed to be accomplished when the water quality in the affected monitor well has been restored to its pre-excursion quality.

**Comment 51**

Ted Long asked if UEC will provide potable water to landowners for human, livestock, and wildlife consumption until baseline water quality parameters are restored.

**Response 51**

If UEC is authorized to conduct *in situ* mining operations, UEC will be required to confine mining solutions within the production zone of the production area. In the event UEC's mining operations resulted in contamination of groundwater off the permitted site, the company would be subject to enforcement actions by the TCEQ, including requirements for corrective action to address the contamination.

**Comment 52**

Lynn and Ginger Cook asked why UEC provided no modeling results regarding water use and the effect the proposed operation will have on local groundwater levels. The Cooks noted the area is experiencing a severe drought, and suggested UEC's groundwater pumping rates should depend on the drawdown of water levels. The Cooks also commented that the disposal of wastewater during the mining and reclamation operation affects the quality and sustainability of the water supply. The Cooks also advocated that the amount of waste disposed should be frequently monitored, and these amounts should be made available to the public.

**Response 52**

Because injection well requirements that apply to *in situ* mining do not regulate the volume of fresh water used by a permittee authorized to conduct *in situ* mining operations, the TCEQ does not have the authority to restrict the applicant's water use, even during a drought. If UEC is issued a Class I injection well permit to authorize its proposed waste disposal well, the permit will establish a limit to the volume of wastewater that can be safely injected, and UEC will be required to submit a quarterly report to the TCEQ that includes the injected volume of wastewater.<sup>65</sup> These records are subject to disclosure under the Texas Public Information Act.

## **H. CONCERNS RELATED TO MINING IN AN UNCONFINED AQUIFER**

**Comment 53**

Judy Lenamon commented that she is opposed to uranium mining in Goliad County because it should not be done in an unconfined aquifer, which is the case for the aquifer in Goliad County. Ronnie Primrose stated that there is evidence that *in situ* uranium mining cannot be done safely in an unconfined aquifer. David and Carol Warren stated that there is evidence that the aquifer in which mining is proposed is unconfined. Gene

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<sup>65</sup> 30 TAC §331.65(b)(1)

and Reta Brown stated that *in situ* uranium mining can be done in a confined aquifer, and asked if the aquifer to be mined is confined.

### Response 53

Information provided in UEC's Class III injection well area permit application and in the PAA1 application indicates that the groundwater in Sand B is under confined conditions. Water levels in Sand B are above the top of this sand,<sup>66</sup> a condition that occurs in confined aquifers. Also, the range of values determined for the storage coefficient of Sand B, reported in Appendix D to UEC's PAA1 application, indicate the groundwater in this sand is under confined conditions.<sup>67</sup>

TCEQ rules do not contain a prohibition on *in situ* mining in an unconfined aquifer. However, such mining typically is done in an aquifer in which the groundwater is under confined conditions. A confined aquifer is preferred because it is completely saturated. Mining in an unconfined aquifer, which is not saturated over its entire thickness, could result in a lowering of the water table in the aquifer to the point the pumps in the production wells are not longer completely submerged, decreasing the efficiency of the recovery of mining fluids.

## I. AQUIFER EXEMPTION

### Comment 54

GCGCD commented that in the TCEQ document of June 2, 2009, the requested aquifer exemption extends from a depth of 45 feet to 404 feet. GCGCD asked how this exemption can be approved for this entire interval when UEC will not be monitoring the entire interval of water-bearing sands. Specifically, GCGCD asked:

1. Water quality results are based on samples taken from well screened across a limited portion of each sand zone;
2. Proposed restoration tables are based on samples obtained from the same wells with limited screen length, and therefore are not representative of the entire saturated thickness as would typically be utilized by a water well;
3. Restoration pore volumes were calculated on partial aquifer sand thickness not the entire sand thickness;
4. On page 5-8 of the UEC response dated March 27, 2009, it states "watering of livestock from the zone (Sand B aquifer) should also be avoided, especially since much higher quality water is locally present throughout the non-mineralized portions of the aquifer." If this higher quality water exists, GCGCD questions how those areas can meet the definition of an aquifer exemption.

GCGCD also commented that there is no evaluation of the acceptable horizontal and vertical boundaries to the aquifer exemption relative to the production zone.

<sup>66</sup> UEC Class III UIC area permit application, tables 6.1 and 6.2

<sup>67</sup> Storage coefficients in the  $10^{-3}$  to  $10^{-5}$  range are characteristic of confined groundwater. See Driscoll, F. C. 1986. *Groundwater and Wells*, 2<sup>nd</sup> ed. Johnson Filtration Systems, Inc. St. Paul, MN, page 69



#### Response 54

A determination of whether or not to exempt a portion of an aquifer must be based on the requirements in 30 TAC §331.13 (Relating to Exempted Aquifer). The Executive Director's recommendation that the 423.8-acre area for which UEC has requested an aquifer exemption, from a depth of 45 feet to 404 feet, encompasses the horizontal and vertical extent of the occurrence of uranium mineralization within this area in which UEC intends to mine for all projected production areas. As allowed under 30 TAC §331.13(c)(2)(B), a portion of an aquifer may be designated an exempted aquifer if it does not currently serve as a source of drinking water for human consumption, and will not serve as a source of drinking water for human consumption because it is mineral, hydrocarbon, or geothermal energy bearing with production capability. Monitoring of the entire exempted area is not a requirement for exemption. Specific monitoring requirements are found at 30 TAC §331.103. The Executive Director determined that the aquifer for which the exemption is requested meets the applicable criteria and recommends that the exemption be granted. The commission makes the decision whether to grant an aquifer exemption, and any designation of an aquifer exemption requires final approval by the U.S. Environmental Protection Agency.<sup>68</sup>

On page 5-8 of UEC's PAA application, UEC recommended that groundwater from Sand B not be used for watering of livestock because of its relatively high radioactivity from radium-226. On the same page, UEC stated that better quality groundwater was available from non-mineralized portions of the aquifer. In its comment, UEC refers to better quality water that is outside the aquifer exemption requested. The presence of better quality water outside the area requested does not preclude designation of an exempt aquifer.

#### Comment 55

Ted Long stated that he disagrees that the groundwater in the area is of such poor quality that the granting of an aquifer exemption is warranted. He stated that those who live adjacent to the site use the same water for drinking, domestic uses, and livestock, and that their wells have been tested and found to be safe for human consumption. Mr. Long asked how a small area surrounded by numerous landowners can be declared to have low quality groundwater when these landowners use water from the same aquifer.

#### Response 55

Analytical data presented in Section 5.0 of UEC application for a Class III UIC area permit indicates that groundwater quality in the area is good except for those areas where uranium mineralization is present. In the areas with uranium mineralization, groundwater contains elevated concentrations of uranium and radium-226 in excess of primary drinking water standards.<sup>69</sup> UEC has requested that 423.8 acres<sup>70</sup> of the Goliad Formation, from a depth of 45 to 404 feet be designated an exempt aquifer. This area contains uranium mineralization in the four sands of the Goliad Formation in quantities that UEC considers to be economically recoverable. Outwards from the mineralized

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<sup>68</sup> 30 § TAC 331.13(d).

<sup>69</sup> UEC Class III UIC area permit, Section 5.0, and UEC PAA1 application, Section 5.0

<sup>70</sup> UEC Class III UIC area permit application, Figure 1.3.

areas the groundwater no longer is in contact with uranium mineralization, and therefore unaffected by it. The portion of the aquifer for which an exemption is requested does not contain water that is suitable for human consumption and no one is using the designated portion for human consumption. The Executive Director emphasizes that the exempt aquifer designation applies only to a discrete portion of the Goliad Formation and not to the entire Goliad Formation.

#### **Comment 56**

Wayne and Margie Smith stated they are opposed to the proposed aquifer exemption because it will allow UEC to destroy groundwater in the area. They emphasized that lowering the water standards is not acceptable to them.

#### **Response 56**

As discussed in Response 55, the Executive Director's recommendation that the 423.8-acre area be designated an exempt aquifer is based on the presence of uranium mineralization. If UEC obtains all the necessary authorizations (including an aquifer exemption) to conduct *in situ* mining at this site, they will be required to restore the groundwater in the mined portion of Sand B in accordance with the requirements in 30 TAC §331.107 (Relating to Restoration). These requirements do allow a company to request that their restoration table be amended to allow the company to restore the groundwater to a quality that is less than its determined pre-mining quality. However, as discussed later in Response 106, the TCEQ can only allow such an amendment after considering the factors in 30 TAC §331.107(g)(1) and making the findings in 30 TAC §331.107 (g)(2).

### **J. GEOLOGY/HYROLOGY OF THE AQUIFER**

#### **Comment 57**

Thomas and Mary Anklam and Wayne and Margie Smith commented that UEC's proposed site is within the recharge zone of the local aquifer. Mr. and Mrs. Manfred Scheurich expressed the concern that the permeable aquifer could be contaminated.

#### **Response 57**

The Executive Director does not agree that the proposed site is within the recharge zone of Sand B. Based on the geology of the proposed site, the mined aquifer is not recharged from infiltration of water from the surface immediately above it. Recharge of the sands of the Goliad Formation occurs in areas more distant from the proposed site where the sands are exposed to the surface or outcrop. And, the proximity of two faults in the area affect the recharge of groundwater in the sand layers. UEC identified two faults in the permit area.<sup>71</sup> The two faults trend northeast-southwest, are about 4,500 feet apart, and offset sediments of the Goliad Formation. The fault in the northwestern part of the proposed permit area is downthrown to the southeast, and the fault in the southeastern part of the area is downthrown to the northwest, creating a graben, or downthrown block between the two faults. On the upthrown (northwestern) side of the northwestern-most fault, Sand A crops out and is unconfined. Southeast of this fault, within the graben,

<sup>71</sup> UEC Class III UEC application Section 7.2

Sand A is overlain by a clay layer. Recharge of Sand A would occur on the upthrown side of the northwestern-most fault, where Sand A is exposed at the surface, but not within the graben, where it does not crop out. None of the other three sands (B, C, and D) crop out in the proposed permit area.

**Comment 58**

GCGCD asked what data the TCEQ used to determine that no communication exists between the production zone (Sand B) and the underlying aquifer (Sand C).

**Response 58**

The five geologic cross sections in Appendix B of the PAA application indicate that there is a continuous layer of clay between the base of Sand B and the top of Sand C. This clay layer should provide hydraulic isolation between these two sands. Additionally, during the pump test PTW-1, two wells completed in Sand C (RBLC-3 and RBLC-4) were monitored. The results of this monitoring, which are included in Appendix D of the PAA application, indicate no hydraulic connection between Sand B and Sand C.

**K. BASELINE DETERMINATION**

**Comment 59**

Joan Fabian, Jacqueline Fonseca, Carol Fulton, Veronica Galvan, Cheri Hart, Donna Hoffman, Lois Huff, Kenneth Izumi, Steven G. Kellman, Barbara Allen-Lampley, Judy Landress, Philip LeMessurier, Kathy B. Newman, Wayne Owens, Catherine Schneider, Ed Sonnen, Mark Sprinkle, Rebecca Sprinkle, Ryan Sprinkle, Mobi Warren, Paul Fitzpatrick, Kelli Wilder, Cyrus Reed of the Lone Star chapter of the Sierra Club, and Patricia Suter and Venice Scheurich, commenting for the Coastal Bend Group of the Sierra Club (CBGSC), expressed concern about the difficulties and controversies in establishing accurate pre-mining baseline groundwater quality. They stated that in particular, there have been serious flaws in calculations of values for the proposed restoration table submitted in UEC's application for PAA1. Mr. Reed further commented that errors in the proposed restoration table values had to be corrected, which brings up questions about the PAA authorization process in general. Mr. and Mrs. Manfred Scheurich expressed the concern that there was imprecision by UEC in record transcription and data processing. CBGSC noted that these errors, first noted by members of their organization, will need to be corrected. Lynn and Ginger Cook commented that errors were found in the data provided in the PAA application, and advised these data should be reviewed by an independent statistician.

**Response 59**

The error in Table 5.2 of UEC's PAA application, which resulted in incorrect calculation of the arithmetic means for uranium and radium-226, respectively, for the baseline wells was addressed in Response 4. UEC has submitted revisions to the PAA application to correct these errors. Based on the review of the revised application information, the Executive Director does not change his recommendation regarding the approval of the application. The new information does alter the restoration table of the draft PAA. The draft PAA has been revised.

**Comment 60**

Richard and Catherine Bettge commented that water quality and quantity will not be restored to baseline levels after mining is complete because the drilling of exploration wells resulted in comingling and aeration of the water sands, resulting in inaccurate baseline data.

**Response 60**

The Executive Director does not agree that exploration or drilling activities prevent the accurate determination of baseline quality or affect restoration techniques. Exploration drilling involves no injection of fluids into the groundwater formation. The borehole is filled with drilling mud, and additional mud is added as the borehole depth is advanced. Because exploration wells drilled in this area generally are a few hundred feet or less in depth, they can be drilled in a day or two, limiting the amount of time the formation is exposed to the drilling mud. The Executive Director understands that some exploration boreholes were left unplugged beyond the time limits allowed by the Railroad Commission, but the Executive Director is not aware of contamination of groundwater that is attributable to unplugged boreholes. The Executive Director understands that the Railroad Commission investigated the concerns that UEC had left boreholes unplugged, and that the matter was resolved to the satisfaction of the RRC.

**Comment 61**

GCGCD expressed concern as to whether or not the water quality test used to develop restoration table values accurately represents the quality of groundwater prior to exploration. GCGCD stated they wished to participate in new verification water quality tests.

**Response 61**

As discussed in Response 61, the Executive Director finds no evidence that exploration drilling affected groundwater quality. Therefore, the Executive Director finds no need for new groundwater sampling to establish pre-mining groundwater quality. The TCEQ cannot require UEC to grant permission to GCGCD to enter property to take groundwater samples.

**Comment 62**

CBGSC asked how UEC guarded against selection bias when they chose locations for the samples of wells. Lynn and Ginger Cook commented that the statistical methodology used for determining baseline groundwater quality may provide biased values and should be considered invalid.

**Response 62**

The Executive Director reviewed the baseline information in the application and determined that it meets the requirements of 30 TAC §331.104. The Executive Director evaluated the location of the baseline wells by visual inspection of the well locations on Figure 1-4. Baseline wells are distributed throughout the proposed production area, with no obvious grouping of wells. The Executive Director finds the baseline well locations

acceptable, and has no reasons to consider the locations invalid for providing unbiased groundwater quality data.

### Comment 63

GCGCD commented that the portion of the aquifer considered for exemption lies within the proposed monitor well ring. GCGCD also commented that because the monitor well ring is the point of compliance for migrating mining fluids, the entire volume of groundwater within the mine area will be contaminated by the mining process. Because of this situation, GCGCD contends that it is invalid to determine pre-mining groundwater quality only on data from analysis of groundwater samples collected from wells completed in the production zone within the production area, as this will result in a pre-mining groundwater quality that is biased high. By determining pre-mining groundwater quality in this manner, GCGCD concludes that UEC will be allowed to restore groundwater to artificially high values, thereby destroying good quality water that now exists throughout most of the mine area.

### Response 63

The Executive Director notes that the area requested for an aquifer exemption extends beyond the mine area of the requested production area authorization.<sup>72</sup> The Executive Director does not agree that groundwater in the production zone throughout the entire mine area will be affected by *in situ* mining or that pre-mining groundwater quality should be based on data from analysis of groundwater samples from the production zone throughout the mine area, rather than just from the production area.<sup>73</sup>

The groundwater quality in the production zone within the production area, at least for certain constituents,<sup>74</sup> is different from that in the production zone from the perimeter of the production zone outwards to the monitor well ring. This is because the groundwater in the production zone within the production area is in contact with uranium mineralization, which affects the quality of that groundwater. Groundwater in the production zone outwards from the production area is not in contact with uranium mineralization, and therefore its quality is not affected by uranium mineralization. Data from analysis of groundwater samples collected from the production zone over the entire mine area would not be representative of groundwater quality in the production zone within the production area. Using data from analysis of groundwater samples collected over the entire mine area to determine the groundwater quality in the production zone within the production area would yield results that are biased low.

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<sup>72</sup> See Figure 1-3, Mine Location Map, UEC PAA1 application.

<sup>73</sup> The production area is that area defined by a line generally through the outer perimeter of injection and recovery wells used for mining (30 TAC §331.2(81)), whereas the mine area is defined by a line through the ring of monitor wells installed to monitor the production zone (30 TAC §331.2(62)). The production area lies within the mine area.

<sup>74</sup> For example, the average groundwater values for uranium and radium-226 in the production zone within the production area are 0.115 mg/l and 333 pCi/l, respectively, whereas the average groundwater values for these two constituents in the production zone outwards from the production area are 0.02 mg/l and 12.1 pCi/l, respectively (Table 5.2 and Table 5.3, UEC PAA1 application).

Also, the repeated injection and recovery of mining fluids will occur in the production zone within the production area, not over the entire mine area. This injection and recovery of mining fluids will affect the quality of groundwater in the production zone within the production area. Pre-mining groundwater quality must be determined for the production zone within the production area under 30 TAC §331.104(b), because it is this groundwater that must be restored once mining is complete. Therefore, pre-mining groundwater quality in this portion of the production zone should be based on data from analysis of groundwater samples from the production zone within the production area.

The effects of *in situ* mining on the quality of groundwater in the portion of the production zone between the perimeter of the production zone and the monitor well ring are minimized for two reasons. First, mining fluids will not be purposefully injected within this portion of the production zone; injection and recovery of mining fluid is restricted to the production zone within the production area. Second, if mining fluids are detected in a monitor well (called an "excursion"),<sup>75</sup> the mine operator is required to clean up all designated monitor wells, all zones outside of the production zone, and the production zone outside of the mine area that contain mining fluids.<sup>76</sup>

#### **Comment 64**

GCGCD commented that a statistically valid approach for establishing baseline water quality is to locate baseline wells throughout the mine area using a systematic grid or by random selection, and references Gilbert, 1987<sup>77</sup> and Matzke, 2007.<sup>78</sup> Specifically, GCGCD commented that baseline well locations for proposed PAAI should be located using 400 ft by 400 ft grid superimposed over the mine area to ensure a minimum of one well every four acres (in this case, 24 baseline wells). Alternatively, GCGCD stated a grid with smaller spacing could be used, with 24 baseline wells chosen randomly.

#### **Response 64**

The Executive Director in general agrees that this method of locating baseline wells is acceptable. However, the Executive Director does not agree that baseline wells should be located within the entire mine area. As discussed in Response 64, it is the production zone within the production area that will be affected by *in situ* mining activities, not the entire mine area. Again, the quality of the groundwater in the portion of the production zone between the outer edge of the production area and the monitor well ring is different from that in the production zone within the production area.

#### **Comment 65**

GCGCD commented that the screens in the baseline wells do not extend over the entire thickness of Sand B, and that no data were provided regarding the quality of the water above and below the screened intervals. GCGCD contends this situation erroneously

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<sup>75</sup> 30 TAC §331.2(38)

<sup>76</sup> 30 TAC §331.106(2)(A).

<sup>77</sup> Gilbert, R.O., 1987, Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold, New York, New York.

<sup>78</sup> Matzke, B. D., 2007, Visual Sample Plan, Version 5.0, User's Guide, PNNL-16939, Pacific Northwest National Laboratory, Richland, Washington.

condemns large volumes of water in the same sand zone that GCGCD contends may be of drinking water quality. GCGCD further commented that the restoration process uses the same erroneous approach regarding screen lengths.

#### **Response 65**

The Executive Director does not agree that the well screening presented in the application condemns groundwater situated above or below the screens. As discussed in Response 22, UEC has set screens across those zones that contain sufficient uranium mineralization to be economically mined using *in situ* methods. It is these zones through which mining fluids will be circulated, and through which groundwater will be circulated during restoration. The same zone that will be affected by mining fluids will be restored. There will be portions of Sand B above and below this zone that will not be affected by either the mining fluids or the groundwater used for restoration.

#### **Comment 66**

Manfred Scheurich asked how the TCEQ can be confident that UEC can restore the groundwater to pre-mining quality, given that United States Geological Survey (USGS) researchers have just begun to study the long-term effects of *in situ* mining on groundwater and the effectiveness of different restoration techniques. He emphasized that over the last two decades, mine operators in Texas have been unable to restore groundwater to pre-mining quality.

#### **Response 66**

*In situ* uranium mining is allowed under current state law.<sup>79</sup> Provided a company meets all applicable requirements, the TCEQ cannot arbitrarily place a moratorium on this activity. The Executive Director is aware that the USGS has initiated a study of the effects of *in situ* uranium mining on groundwater. In fact, the TCEQ made the USGS aware of available historical data from Texas *in situ* uranium mines, and provided this information to the USGS, which was the basis of a USGS Open-File report.<sup>80</sup>

As will be further discussed later in Response 105, the Executive Director acknowledges that mining companies have not always succeeded in restoring groundwater in mined aquifers to pre-mining conditions, and that the commission has approved amendments to restoration values of PAAs for various constituents and parameters in the groundwater. Restoration table amendments are authorized in law, and the TCEQ follows the process established in 30 TAC §331.107(g)(1) and (2). An application to amend the restoration table values of a PAA is subject to public notice, opportunity to provide public comment, and an opportunity to request a contested case hearing.

#### **Comment 67**

Venice Scheurich and Patricia Suter, representing the Coastal Bend Chapter of the Sierra Club (CBCSC) noted that baseline wells were sampled in two groups: An initial group of

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<sup>79</sup> Both the Texas Injection Well Act, Texas Water Code Chapter 27, and TCEQ rules in 30 TAC Chapter 331 authorize the use of injection wells for *in situ* recovery of uranium.

<sup>80</sup> Hall, Susan, 2009, *Groundwater Restoration at Uranium In-situ Recovery Mines, South Texas Coastal Plain*, USGS Open-File Report 2009-1143.

ten wells and a subsequent group of eight wells, with a period of several months between the sampling of the two groups of wells. With regards to sampling of the two wells groups, CBGSC asked the following questions:

1. Why did UEC sample the baseline wells in two groups?
2. Could it be that UEC anticipated or expected uranium levels in the second group of wells would be higher than levels in the first group?
3. Was the data from the sampling of the ten wells used to select the locations for wells in the second group, enabling UEC to select locations with high uranium values?
4. Given that 239 exploration wells have been drilled in the production area prior to any drilling of baseline wells, could UEC have used the data from these boreholes to choose locations with high uranium values?
5. Did UEC use either a systematic grid or some type of probability sampling design to determine the baseline well locations, or if not, did UEC use personal judgment to select baseline well locations, which may have introduced a bias that cannot be quantified?
6. Does the TCEQ acknowledge that increasing the sample size for baseline wells from ten to 18 does not assure more accurate estimates of groundwater quality unless UEC used a statistically valid sampling design that is not subject to bias as described in question 5 above?
7. What criteria did the TCEQ use to judge whether or not UEC's choice of locations for the 18 baseline wells resulted in a representative sample?
8. What, if anything, in TCEQ's criteria given in the answer to question 7 above would have disqualified the sample of the first ten baseline wells as representative and sufficient to provide values for a restoration table?

#### **Response 67**

At the time UEC submitted the PAA application, a minimum of five baseline wells were required.<sup>81</sup> This requirement was subsequently changed in TCEQ rulemaking to a minimum of five baseline wells or one baseline well for each four acres of production area.<sup>82</sup> To comply with the new requirements, UEC revised their PAA application to include the additional eight wells. Therefore, the baseline wells for PAA1 are in three groups: the four RBLB (Regional Baseline Sand B) wells drilled in 2007, PTW-1 (Pump Test Well) through PTW-6 drilled in April of 2008, and PTW-7 through PTW-14, drilled in August of 2008. The second set of PTW wells were sampled later than the first set because they had not been drilled at the time the first set were sampled. The Executive Director has no information to suggest that UEC sampled the second set of wells purposefully to obtain higher uranium values or that the second set of PTW well locations were based on the analytical results of groundwater samples from the first ten baseline wells or from data from exploration wells. As discussed in Response 63, the Executive Director evaluated the location of the baseline wells by visual inspection of the well locations on Figure 1-4. Baseline wells are distributed throughout the proposed production area, with no obvious grouping of wells. The Executive Director finds the

<sup>81</sup> 30 TAC 331.104(a)(2) prior to March 12, 2009 rule changes (34 Tex Reg 1638).

<sup>82</sup> 30 TAC 331.104(a)(2) prior to March 12, 2009 rule changes (34 Tex Reg 1638).



baseline well locations acceptable, and has no reason to consider the locations invalid for providing unbiased groundwater quality data. Thus, the Executive Director determined that the baseline well locations were sufficient for providing baseline information under 30 TAC §331.104. Also, the Executive Director notes that use of a systematic grid would also be acceptable but is not required by rule. Additionally, the Executive Director notes that increasing the sample size for estimation of the mean provides a better estimate.

#### **Comment 68**

CBGSC commented that 30 TAC Chapter 331 includes requirements for monitor well locations, but not baseline well locations, and asked why these rules do not contain specific requirements for determining baseline well locations. CBGSC suggested such specific requirements would be beneficial for the following reasons:

1. All stakeholders would understand why data used in construction of the restoration taken from wells that were located in an unbiased manner;
2. Industry could no longer be justifiably accused of selecting well locations that would yield high values for groundwater constituents; and
3. TCEQ could not longer be suspected of favoring industry in this manner.

#### **Response 68**

The Executive Director notes that there are distance requirements for production area monitor wells.<sup>83</sup> With regards to baseline wells, there are no rule requirements regarding the specific location of baseline wells. The previous requirement for at least five baseline wells was amended to a minimum of five baseline wells or one baseline well for every four acres of production area, whichever is greatest.<sup>84</sup> Therefore, for any proposed production area greater than twenty acres in size, more baseline wells are now required.

The Executive Director does not agree that the historic practice of the selection of baseline well locations has been done in a manner favorable to the mining companies. The Executive Director does not agree that companies have purposefully located baseline wells in a manner that will yield high values for the groundwater constituents on which restoration is based, thereby making it easier to achieve restoration.

The TCEQ's rules for determining baseline and restoration values are promulgated through a formal administrative rulemaking process that includes opportunities for public input, and the Executive Director implements these rules in reviewing an application for a Production Area Authorization.

#### **Comment 69**

CBGSC noted that UEC stated they would drill seven additional baseline wells,<sup>85</sup> yet they drilled eight additional wells. CBGSC asked why UEC made the decision to sample eight wells instead of seven.

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<sup>83</sup> 30 TAC §331.103.

<sup>84</sup> 30 TAC §331.104, as amended in 34TexReg 1638.

<sup>85</sup> UEC PAA1 application, page 1-9.

#### **Response 69**

The Executive Director notes that in the March 27, 2009 revision to the application, UEC added the clarification on page 1-9 that eight additional baseline wells were installed. The Executive Director is not aware of the applicant's rationale for using eight instead of seven, but believes that providing more baseline wells provides better information.

#### **Comment 70**

CBGSC commented that baseline well PTW-14 was originally designated CBP-1 (Core B Sand Production), and was sampled two months prior to sampling of the other additional seven wells (PTW-7 through PTW-13), and asked the following questions

1. Why this well was renamed;
2. Why was it sampled earlier than the other wells;
3. Are there more CBP-designated wells, or other wells (such as additional wells completed in Sand A; that is the OMW monitor wells);
4. If there are more CBP wells and other wells, how many are there and where are they located in the production area.
5. What was the initial purpose of CBP-1, prior to being designated as a baseline well, and when was the first laboratory report for this well

#### **Response 70**

The Executive Director does not know why the designation of CBP-1 for this well was later changed to PTW-14, other than perhaps to be consistent regarding the designation of baseline wells. There are possibly more CBP wells and other wells, but the Executive Director is not aware of their locations, or whether or not they have been plugged and abandoned. The Executive Director also is unaware of the original purpose (if any) of this well, why this well was sampled at an earlier date than PTW-7 through PTW-13, or if there are any initial sample results for this well. Overall, the Executive Director found no reason to suspect the designation of PTW-14 as a baseline well. The Executive Director determined that the application met the applicable requirements for determining baseline under 30 TAC §331.104.

#### **Comment 71**

CBGSC noted that on page 1-9 of UEC's PAA1 application, the company states that it exceeded the minimum required number of baseline wells by completing 17 wells, and that sample data were submitted for ten of those wells. CBGSC asked the following questions in regard to this statement:

1. Why initially were sample analyses submitted for only ten wells?
2. Are laboratory reports available for the seven wells which were not included in the initial PAA application?
3. What names or labels were given to these seven wells?
4. Is a production area map available indicating the locations of these seven wells?
5. What was the purpose of these seven wells?

#### **Response 71**

The inclusion of the additional eight baseline wells was explained in Response 68. Laboratory results from analysis of groundwater samples from all 18 baseline wells are in

Appendix A of UEC's PAA application. The additional wells were designated as PTW-7 through PTW-14, respectively. All baseline well locations are on Figure 1-4 of the application. As described in Response 68, the purpose of the additional eight wells was to meet the new rule requirements for the required number of baseline wells.

#### Comment 72

CBGSC stated that on page 1-9 of UEC's March 27, 2009 revisions to the PAA application, UEC stated that seven additional baseline wells were scheduled to be sampled in September, and that TCEQ was planning to collect samples from some of the baseline wells during this sampling event. CBGSC also noted that UEC stated it planned to supplement the production zone water quality baseline data with results from this sampling event. CBGSC asked the following questions with regard to this matter:

1. Has this sampling been done, and if not, when will it be done?
2. Has the new data been added to the application?
3. Has UEC submitted revisions to the application to include this information, and if not, when will revisions be submitted?

#### Response 72

On September 3-4, 2008, representatives from the TCEQ participated in sampling of some baseline and monitor wells at the UEC site. UEC has not submitted revisions to the PAA application based on the results of this sampling event. During this sampling event, TCEQ staff sampled eight wells at the UEC site:

Well	Unit	Purpose
OMW-6	Sand A	PAA1 monitor well in overlying aquifer
RBLA-1	Sand A	Regional baseline well for Sand A; outside of PAA1
BMW-3	Sand B	PAA1 production zone monitor well
BMW-14	Sand B	PAA1 production zone monitor well
PTW-8	Sand B	PAA1 production zone baseline well
RBLB-2	Sand B	Regional baseline well; outside of PAA1
RBLC-1	Sand C	Regional baseline well for Sand C; outside of PAA1
RBLD-2	Sand D	Regional baseline well for Sand D; outside of PAA1

Samples collected by TCEQ Staff were analyzed for the 26 constituents listed in 30 TAC §331.104(b). The results of these analyses were compared to the ranges of values for each well group. Although some of the sample values were either above or below the ranges for their respective well group, the majority of values are within their respective ranges.

With regard to upper control limits for excursion detection in Production Area 1, the values for the two control parameters, chlorides and conductance, are within the ranges for the OMW wells.<sup>86</sup> Therefore, the upper control limits for these parameters are not affected,<sup>87</sup> as these upper control limits are based on the highest respective value for each control parameter. In the two BMW wells, the value for chlorides for BMW-14 was 150

<sup>86</sup> Table 5.1 of UEC's PAA1 application.

<sup>87</sup> Attachment 5, UEC Final Draft PAA1.

mg/l, which is below the range of 158 to 172 mg/l for the BMW wells. As with the OMW wells, the values for the upper control limits for chlorides and conductance are not affected. The results from OMW-6, BMW-3, and BMW-14 do not affect the upper control limits for excursion detection in Sand A or Sand B.

The TCEQ sample results were also compared to the restoration values.<sup>88</sup> For well PTW-8, which is a production zone baseline well, the sample values for three constituents were outside of their respective ranges for baseline wells.<sup>89</sup>

Constituent	Range (mg/l)	Value (mg/l)
Molybdenum	0.014 – 0.136	0.00882
Nitrates	0.02 – 1.73	0.01
Silica	12.1 – 37.5	41.0

Inclusion of these TCEQ-sampled values for determination of baseline for aquifer restoration, rather than the values used by UEC in the application, would result in changes to the baseline values in the restoration table in the draft PAA for these constituents. Because the Executive Director does not consider the changes to the restoration values for molybdenum, nitrates or silica to be significant, the Executive Director does not recommend a change to the restoration table based on data from the TCEQ sampling.

#### Comment 73

CBGSC commented that the 0.804 milligrams per liter (mg/L) uranium value for the groundwater sample from baseline well PTW-7 is an extreme value ("outlier"), and asked the TCEQ to provide justification for using the sample mean instead of the sample median for the uranium value in the proposed restoration table. CBGSC noted that the TCEQ stated use of the sample median is an example of accommodation of an outlier.<sup>90</sup> CBGSC also noted that using the uranium values from the 18 baseline wells, the sample mean for uranium is 0.115 mg/l, and the sample median is 0.071 mg/l. CBGSC also noted that if the uranium value for PTW-7 is ignored, the sample mean is 0.075 mg/l, and that the uranium value for PTW-7 dramatically raises the sample mean. In regard to this comment and these notes, CBGSC asked if the TCEQ would agree that using the sample median of 0.071 mg/l for the uranium restoration value is better than using the sample mean value for uranium of 0.115 mg/l. GCGCD commented that the statistical methodology used for determining baseline groundwater quality may provide highly skewed values.

#### Response 73

Although the Executive Director did not evaluate this data using an outlier test, simple observation indicates the uranium value for PTW-7 is an outlier. However, this fact in no way invalidates this value, nor is the Executive Director aware of any evidence that this value is due to an error caused by sample contamination, transcription, or analytical

<sup>88</sup> Attachment 6, UEC Final Draft PAA1.

<sup>89</sup> Table 5.2 of UEC's PAA1 application.

<sup>90</sup> 2015 TCEQ Report.

method. Therefore, there is no justification for ignoring this uranium value, as suggested by CBGSC. Indeed, in the absence of evidence of an erroneous value, EPA guidance recommends inclusion of outliers in a data set.<sup>91</sup>

UEC used the sample mean for determining baseline. Use of the sample mean for estimating pre-mining groundwater quality is specifically allowed by TCEQ rule<sup>92</sup> and has been the historic practice in Texas. However, The rules also allow the use of other statistical methods, subject to approval by the executive director.<sup>93</sup> Use of the sample mean is specifically allowed by rule because the Executive Director considers the method to be conservative. If the sample mean is used to determine pre-mining groundwater quality, then restoration is based on a comparison of the pre-mining sample mean to the sample mean determined from data collected after restoration activities. Therefore, the premining information is subject to the same statistical methods as the post-restoration information.

#### Comment 74

Blackburn Carter (BC) commented that in accordance with the requirements of 30 TAC §331.104 (Relating to Establishment of Baseline and Control Parameters for Excursion Detection), independent and representative groundwater samples are required. BC expressed the opinion that the data submitted in the PAA application does not meet either of these requirements. CBGSC commented that they and other citizens concerned about groundwater are depending on the TCEQ to exercise its prerogatives regarding the location of baseline wells at UEC's proposed PAA1. In regard to this comment, CBGSC emphasized the following quotes:

"Protection of groundwater quality is the most significant concern regarding *in situ* uranium mining." (Executive Director's 11/06/09 Response to Comment Permit UR03075).

"...the commission takes into consideration whether the samples used to establish baseline are representative...Obtaining representative samples would certainly involve evaluation of the locations of baseline wells, and any evaluation by the commission regarding whether samples are representative would include consideration of how baseline wells were located." (34 TexReg 1652, emphasis CBGSC).

"...the commission can determine that a sample data set is not representative, as required under 331.104(a), and require additional samples from existing baseline wells or the completion of additional baseline wells." (34 Tex Reg 1668, emphasis CBGSC).

#### Response 74

The Executive Director reaffirms that protection of the groundwater is the most significant concern regarding *in situ* uranium mining. Also, the Executive Director

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<sup>91</sup> EPA, 1989, *Guidance Document on the Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities*, Interim Final Draft, page 8-12.

<sup>92</sup> 30 TAC §331.107(a)(1)(A).

<sup>93</sup> 30 TAC §331.107(a)(1)(B).

emphasizes that the purpose of the underground injection control rules in 30 TAC Chapter 331, UEC's proposed draft Class III injection well area permit, and draft PAA1 is to protect underground sources of drinking water and fresh water from pollution. If permitted to conduct *in situ* uranium mining operations, UEC would be required to restore groundwater in the mining zone under the requirements of 30 TAC § 331.107. The Executive Director evaluated the placement and number of baseline wells and finds that they provide independent and representative water samples for determining baseline quality and restoration values. The Executive Director concluded that the baseline information complies with the requirements of 30 TAC §331.104.

#### **Comment 75**

GCGCD stated it does not believe that the baseline water quality data provided in UEC's PAA1 application accurately represents naturally-occurring radionuclide concentrations. GCGCD further states that in the Response to Public Comment on UEC's draft Class III injection well area permit, the Executive Director alludes to naturally-occurring reducing conditions.<sup>94</sup> GCGCD contended that it is a direct contradiction to have an ore deposit formed due to reducing conditions and at the same time have high levels of naturally-occurring radionuclides (emphasis GCGCD).

#### **Response 75**

The Executive Director does not agree that the baseline data are not representative of naturally-occurring radionuclide levels. This area has never been mined using *in situ* mining methods or other activities that would affect the radionuclide concentrations. As discussed in Response 77, next, the Executive Director finds no evidence that groundwater quality in this area was affected by exploration drilling.

The accepted explanation for the uranium mineralization at this site and at other South Texas sites is the result of oxidizing water being introduced into these aquifers, traveling through the aquifers, and dissolving uranium from volcanic ash in the aquifers.<sup>95</sup> As these uranium-bearing waters migrated further through the aquifer, they encountered chemically reducing conditions that resulted in precipitation of the uranium, creating the uranium orebody. The fact that reducing conditions exist today does not mean that no uranium can be dissolved in the groundwater that is in contact with the uranium mineralization. Although these conditions result in most of the uranium remaining undissolved, some will be dissolved into the groundwater as a result of chemical equilibrium between solid phase uranium and dissolved phase uranium.

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<sup>94</sup> Executive Director's Response to Public Comments on Application by Uranium Energy Corp, TCEQ Permit No. UR03075.

<sup>95</sup> For example, see Galloway, W. E., and Kaiser, W.R., 1980, *Catahoula Formation of the Texas Coastal Plain: Origin, Geochemical Evolution, and Characteristics of Uranium Deposits*, Bureau of Economic Geology, University of Texas at Austin, Bulletin 100, 100.

## L. DEGRADATION OF WATER QUALITY DURING EXPLORATION PHASE

### Comment 76

Blackburn Carter (BC) expressed concern with the mining application and the PAA application regarding the role of siting, drilling, development, and sampling, which, according to BC, began in the exploration phase and continues. BC stated that exploration activities contaminated the results of the baseline testing, and because of this UEC should be required to drill and develop a series of baseline wells under a carefully controlled set of variables in order to provide additional evidence that the company can provide independent and representative samples. BC requested that their representatives be present during sampling, and be allowed to split samples. Ted Long commented that if baseline water data has been compromised due to inadequate quality control during exploratory drilling, post-mining water quality will be less than pre-mining water quality. GCGCD requested that the TCEQ perform a full technical evaluation of the potential impact on groundwater quality as a result of the drilling of numerous uncased boreholes. Lynn and Ginger Cook supported this request.

### Response 76

As described in Response 38, the Executive Director finds no evidence to suggest that exploratory drilling affects groundwater quality of the proposed production area. The Executive Director assumes the references to uncased boreholes arises from UEC's exploratory drilling. Exploratory drilling is under the jurisdiction of the Railroad Commission (RRC). Therefore, any evaluation or study of the effect of exploratory drilling on water quality is under the jurisdiction of the RRC. An investigation by the RRC found no evidence that groundwater had been contaminated by unplugged boreholes. As described in Response 18, the Executive Director does not believe that the well development methodology led to contamination of groundwater or affected the ability to determine baseline water quality. The Executive Director does not have the authority to grant permission to individuals to enter private property to take groundwater samples.

### Comment 77

Thomas and Mary Anklam commented that their well water has been tested three times, and that sodium, sulfates, and iron in the water have increased over time. The Anklaams also commented that the water from their well has turned red from high levels of iron. Ray and Kathy Albrecht commented that their well water is discolored and that the well is producing increased amounts of sediment, requiring more frequent replacement of water filters. Ted Long commented that his private water well is contaminated with iron bacteria, and noted that he had never experienced this condition prior to exploration drilling by UEC in the area. Mr. Long questioned the explanation that the iron bacteria in his well is naturally-occurring. Larrie and Brenda Brysch commented that groundwater contamination is already occurring, and that citizen concerns have not been addressed by various government agencies. G. A. Gutmann commented that he has seen groundwater samples from water wells on property next to where UEC has been drilling exploration wells, and feels strongly that water in northern Goliad County is being contaminated.

Weldon Scott Orr commented that he and his family depend on their well for domestic use and for livestock, and is their only source of potable water. Mr. Orr stated that uranium exploration activities have had a profound effect on the performance of his well and on the quality of water from it. Patrick and Denise Lovett commented that they were opposed to issuance of the production area authorization because of the groundwater contamination due to exploration drilling by UEC.

#### **Response 77**

Based on information provided in Table 5.1 of UEC's application for a Class III injection well area permit, a water sample from the Anklam's well contained 99 mg/l sodium, 38 mg/l sulfates, and less than 0.01 mg/l iron. The Executive Director cannot verify that the changes in water quality noted by the Anklaams were caused by exploration activity.

The drilling of exploration wells at this site is authorized by a permit from the Railroad Commission (RRC). The Executive Director understands that the RRC has investigated public concerns regarding drilling, and found no evidence that iron bacteria problems in local wells was associated with exploration drilling. The Executive Director is not aware of contamination of water wells that is attributable to unplugged boreholes. The Executive Director understands that the RRC investigated concerns that UEC left boreholes unplugged, and that the matter was resolved to the satisfaction of the RRC.

If UEC's Class III injection well area permit and PAA are approved, and if UEC receives other authorizations needed for in situ mining operations, UEC will be required to meet all applicable regulatory requirements in 30 TAC Chapter 331. These regulations are designed to protect groundwater quality in the vicinity of an *in-situ* mining operation. In over 30 years of *in situ* uranium production at over 30 sites in Texas, not occurrences of off-site groundwater contamination have been documented. Although changes in water quality cited by commenters coincided in time with exploration activities, there is not a scientific basis by which the Executive Director can conclude that the proposed mining activities would exacerbate the problem.

#### **Comment 78**

Kenneth Buelter commented that UEC should be required to manage the mining operation as an "Area of Known Contamination," and be required to provide the TCEQ with sufficient sample data to verify that the area with contaminated groundwater is not increasing. Mr. Buelter further recommended that any movement of known contaminants should require UEC to cease mining operations until this movement is stopped.

#### **Response 78**

The Executive Director does not know the origin and meaning of the commenter's term, "Area of Known Contamination", but notes that EPA has defined the term "Area of Contamination" as an area of contiguous contamination.<sup>96</sup> The term is used in connection with sites where remediation of hazardous waste contamination is conducted, such as

<sup>96</sup> EPA National Oil and Hazardous Substances Pollution Contingency Plan, at; 55 Federal Register 8758-63; Management of Remediation Waste Under RCRA, EPA530-F-98-026, October 1998/



CERCLA<sup>97</sup> ("Superfund") sites or Corrective Action at RCRA<sup>98</sup> facilities (hazardous waste management facilities).

The comment seems to imply that groundwater at the proposed site has been contaminated, and that UEC should be required to clean it up. The Executive Director recognizes that the groundwater in the production zone within the proposed production area contains levels of certain constituents that make it unsuitable for human consumption.<sup>99</sup> However, this situation is the result of naturally-occurring uranium mineralization, not man-made contamination. Therefore, the Executive Director has no basis for declaring the proposed production area an "area of contamination" subject to Superfund or RCRA corrective action. Once mining operations are concluded, the permittee will be required to restore the affected aquifer according to the requirements of 30 TAC §331.107 and according to the PAA and the permit.

## M. MONITORING

### Comment 79

Ronnie Primrose expressed concern about a lack of independent monitoring and stated that two unannounced inspections by TCEQ were inadequate. David and Carol Warren commented that the lack of monitoring at the site by outside sources provides the industry too many opportunities to not report problems. They further stated that allowing the permittee to conduct monitoring allows for cover-ups, dishonesty, slow reporting of problems, and data tampering. They also noted that monitoring will be done by UEC, with only one or two site visits a year by the TCEQ, which they consider to be unacceptable. Ted Long commented the TCEQ was too lenient in allowing the company to conduct the required groundwater monitoring, and suggested UEC would submit skewed data, which will result in groundwater contamination. Mr. Long asked if provisions are in place for monitoring of both water quality and water quantity by an unbiased, independent firm.

### Response 79

Self-reporting is an aspect of all TCEQ programs. The Executive Director recognizes the perception of a conflict of interest in self-reporting. However, it is not practically or financially possible for the TCEQ to physically collect samples and analyze them for every regulated facility with the frequency required by the many programs under its jurisdiction. Fortunately, there are several safeguards in place to help ensure the validity of information that is self-reported. First, all analytical data submitted to the TCEQ by a regulated person must be certified as being true and correct; falsification of any data constitutes fraud and could subject the permittee to enforcement and criminal prosecution. Second, analytical data submitted to the TCEQ must be from laboratories that meet the accreditation requirements of 30 TAC Chapter 25. Third, all data is reviewed by the TCEQ; any apparent inconsistencies would be investigated. Fourth, TCEQ periodically collects samples at facilities and has them analyzed at the Texas

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<sup>97</sup> Comprehensive Environmental Response, Compensation and Liability Act; 42 U.S.C. §§ 9601 *et seq.*

<sup>98</sup> Resource Conservation and Recovery Act; 42 U.S.C. §§ 6901 *et seq.*

<sup>99</sup> UEC PAA1 Application, Table 5-2.

Department of State Health Services laboratory in Austin, Texas. Lastly, all information associated with sampling is in the public record and available to anyone who wishes to inspect it.

#### **Comment 80**

GCGCD commented that UEC provided no scientific basis for the locations of the monitor wells completed in Sand A and Sand B. GCGCD noted that the NRC advises<sup>100</sup> that monitor wells should be located to maximize the detection of vertical excursions, and asked if the wells completed in Sand A<sup>101</sup> were placed in areas of Sand A that had the highest hydraulic conductivity and the best communication with Sand B.

#### **Response 80**

The Executive Director's review of UEC's application indicates that monitor well locations meet the requirements of 30 TAC §331.103. The production zone monitor wells are sufficiently spaced and located to detect lateral excursions from the production area. The non-production zone monitor wells are sufficiently located to monitor vertical movements of mining fluids to ensure containment.

#### **Comment 81**

GCGCD commented that UEC stated in its application that chloride and conductivity were chosen as indicator parameters for excursion detection, but that uranium was not chosen as an indicator parameter because it has seldom been detected during an excursion, as is evidenced by thousands of water samples collected from monitoring wells at *in situ* mining sites in Texas. GCGCD asked why UEC did not provide a summary of this data in the application to support its contention that uranium is not a good indicator parameter for excursion detection. GCGCD further stated that the NRC notes that uranium *may* (emphasis GCGCD) not be a good excursion indicator because it *may* (emphasis GCGCD) be removed by reducing conditions in the aquifer prior to the excursion reading the monitor well. Lastly, GCGCD stated the mining fluid is designed to destroy the reducing conditions in the aquifer, and that there is considerable evidence that uranium concentrations continue to increase after restoration. Because of this phenomenon, GCGCD contends that to establish scientific validity in the statement that reducing conditions in the aquifer prevent uranium from reaching most of the monitor wells, samples should be collected at the monitor wells surrounding restored *in situ* mines to demonstrate that uranium concentrations are not increasing over time.

#### **Response 81**

Information from historical files indicates that uranium has been used as an indicator parameter for excursions at 36 *in situ* uranium sites in South Texas. Because each monitor well at each site must be sampled twice a month (twice a week during excursions), the collection and analysis of thousands of groundwater samples has occurred. Further information from historical files indicates that from 1989 through 2000, uranium was detected during one excursion. Most excursions were detected due to

<sup>100</sup> NUREG 1569, page 5-42.

<sup>101</sup> Wells completed in Sand A, which overlies the Sand B production zone, are designated as the OMW

changes in chlorides or conductivity. The NRC does not consider uranium to be a good excursion indicator because although it is mobilized by *in situ* leaching, it may be retarded by reducing conditions in the aquifer.<sup>102</sup> The Executive Director notes that once an excursion has been verified, the mine operator is required to sample the groundwater for uranium and other additional constituents.<sup>103</sup> During restoration and stability periods, uranium levels are evaluated within the production area, and increasing uranium levels would indicate that restoration is not complete and that stability has not been achieved.

#### **Comment 82**

GCGCD commented that UEC spaced the production zone monitor wells about 350 feet apart, but provided no discussion of the technical factors the NRC<sup>104</sup> advises should be considered: the monitor wells from the edge of the well field, the minimum likely size of an excursion source zone, groundwater flow direction and velocity outside of the well field, and the potential for mixing and dispersion. GCGCD also commented that the monitor well ring is placed the maximum allowed distance from the production area. According to GCGCD, it would take a catastrophic excursion to have any chance of detection, given the distance the monitor wells are from the production area. Blackburn Carter commented that the 400 ft spacing for the production zone monitor wells is the maximum spacing allowed by rule, but that UEC offers no justification for this spacing. BC also commented that the number of monitor wells in overlying Sand A is the minimum required by rule, and again, UEC offered no justification for the placement of monitor wells in overlying Sand A. BC stated that UEC should be required to consider the variability of sands A and B and their relation to bordering surface water bodies.

#### **Response 82**

The Executive Director is required to evaluate applications based on the laws of the State of Texas and TCEQ rules. Production zone monitor wells must meet TCEQ requirements in 30 TAC §331.103. The Executive Director notes that the referenced NRC guidance states: "Previously approved *in situ* leach excursion monitoring systems used monitor wells as far as 180 m [600 ft] and as near as 75 m [250 ft] from the well field edge (NRC, 2001, Table 4-6). The licensee should be afforded some discretion in determining the appropriate distance of horizontal excursion monitor wells from the well field, but should provide justification for distances greater than about 150 m [500 ft]."

As noted by GCGCD, the UEC production zone monitor wells are spaced about 350 feet apart, a distance within the recommendations of the NRC guidance document and that meets the requirements of 30 TAC §331.103. Also, the Executive Director notes that Sand B is a continuous, essentially flat sand of relatively consistent thickness. Under these geologic conditions, UEC's monitor well system should be adequate for the timely detection of excursions. As discussed more later in Response 104, there is no evidence that groundwater in Sand B is connected to any surface water feature.

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<sup>102</sup> NUREG 1569, page 5-41

<sup>103</sup> 30 TAC §331.106(2).

<sup>104</sup> NUREG-1569, page 5-42.

#### **Comment 83**

GCGCD commented that well screens in the OMW (overlying monitor wells) wells, which are completed in Sand A, should be at the base of Sand A to ensure detection of excursions from Sand A to Sand B.

#### **Response 83**

The information in Appendix C (Relating to Well Logs and Completion Reports) of UEC's PAA1 application indicates that the screens in the wells completed in Sand A are at the base of Sand A.

#### **Comment 84**

GCGCD noted that UEC proposed to set upper control limits for chloride and conductivity at 25 percent above the highest value recorded from production zone monitor wells, as is recommended in some cases by the NRC.<sup>105</sup> GCGCD commented that this method is protective only in the event of a rapid increase in the concentration of an excursion parameter. According to GCGCD, this situation would occur infrequently because the distance the monitor wells are from the production area (400 feet) will result in dilution of mining fluids before they reach the monitor wells. GCGCD commented that this is not a legitimate or representative method.

GCGCD stated that if the upper control limit is not reached, contamination will travel past the monitor wells, as the company does not have to take action until the upper control limit is exceeded. GCGCD notes that the EPA recommends monitoring both for a sudden increase and a gradual increase in contamination using the Shewhart-cumulative sum control chart (Shewhart-CUSUM Control Chart).<sup>106</sup> GCGCD described the use of this method and provided an example using chloride data from monitor wells BMW-18 through 22. The purpose of the example was to illustrate that using a control chart methodology would result in declaration of an excursion for chlorides while use of UEC's proposed method (upper control limit =  $1.25 \times$  largest chloride value, or 209 milligrams per liter) would not result in declaration of an excursion.

To construct the control chart, it appears GCGCD assumed the respective chloride values for each of these five wells<sup>107</sup> represented the initial average value for chlorides in each well. Then, GCGCD assumed the chloride values in each well increased over time, but not in exceedence of 209 milligrams per liter (mg/l). Although the assumed individual chloride values did not exceed 209 mg/l, the CUSUM eventually did.

According to GCGCD, this hypothetical example indicates that mining fluids could be traveling past the monitor well ring and affecting groundwater outside of the proposed aquifer exemption area without declaration of an excursion. GCGCD further states that this situation has important implications for obtaining an extension of the requested aquifer exemption because this undetected contamination will affect future baseline

<sup>105</sup> NUREG 1569, page 5-41.

<sup>106</sup> EPA, 1992, *Statistical Analysis of Ground-water Monitoring Data at RCRA Facilities*, Draft Addendum to Interim Final Guidance.

<sup>107</sup> UEC PAA1 Application, Table 5.2.

sampling performed outside of the monitor well ring, resulting in higher restoration values and a manipulated basis for an aquifer exemption.

#### **Response 84**

The TCEQ rules under which the Executive Director evaluated this application do not specify a particular method or parameters that must be used to detect excursions; rather, the rules require that the permittee prevent off-site migration of fluids, leaving flexibility as to the method and parameters appropriate to the specific site. Chlorides have been used as an excursion indicator at numerous *in situ* uranium mining sites in South Texas, and have proven to be a reliable indicator of excursions.<sup>108</sup> At sites where multiple indicator parameters were used, all excursions were identified by chlorides or conductivity, or both. In addition to the parameters, the method used by UEC has proven a reliable method under similar geologic conditions. The Executive Director appreciates GCGCD's hypothetical example, but notes that the specific data used to construct this example was not provided. Therefore, the Executive Director cannot assess the validity of this example.

#### **Comment 85**

GCGCD commented that the respective locations for the production zone monitor wells are not appropriate for detection of excursions. GCGCD notes that using UEC's estimates of 7.9 feet per year<sup>109</sup> for groundwater velocity, it would take mining fluids 50 years to reach one of the production zone monitor wells, which are 400 feet from the edge of the production area. Lynn and Ginger Cook expressed the same concern. GCGCD questioned how this situation allows for detection of an excursion during the mining operations and allow timely corrective action. GCGCD stated the production zone monitor wells must be placed sufficiently close to the production area to be effective, and that UEC should not be allowed to use the maximum allowed distance from the production area without providing justification for using the maximum distance allowed by rule.<sup>110</sup> Richard Bettge commented that at the rate of groundwater movement it could be over ten years before anything is detected in a monitor well.

#### **Response 85**

Under normal flow conditions, which UEC estimated to be about 7.9 feet a year, it would take groundwater about 50 years to flow the 400 feet from the edge of the production area to a production zone monitor well. However, during mining operation groundwater in the production area will not flow under ambient conditions. Pumping water into and out of the production zone of the production area will change native flow rates and gradients. The monitor wells are present to detect changes caused by mining operations. Placing the production zone monitor wells closer to the production area would be problematic because for some distance outward from the edge of the production area, the pumping of production wells will cause groundwater to travel toward the production area. Therefore, the monitor wells must be placed a sufficient distance from the edge of the production

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<sup>108</sup> The Executive Director notes that the groundwater will be monitored both for chlorides and conductance, not just chlorides.

<sup>109</sup> GCGCD noted that they do not necessarily agree with this groundwater velocity.

<sup>110</sup> 30 TAC §331.103(a).

area so they are located outside the area affected by production wells in the production area. It is this inwardly-directed flow of groundwater that helps protect outlying groundwater from contamination by migrating mining fluids. Monitor wells are still required, however, to protect against the possibility that the injection of mining fluids may inadvertently direct groundwater flow outward from the production area, resulting in groundwater flow that is faster than the natural gradient. The Executive Director reviewed the application and concluded that the proposed production zone monitor wells meet the rule requirements of 30 TAC §331.103.

#### **Comment 86**

GCGCD commented that there are no data or monitor wells to protect the underlying Sand C. Lynn and Ginger Cook questioned why there is no requirement in the proposed PAA for monitoring of sands that underlie Sand B, the production zone, and noted that groundwater can move vertically as well as horizontally. BC commented that monitor wells should be required in sands that underlie Sand B, although BC acknowledged the regulations do not specifically require monitor wells in aquifers underlying the production zone. BC emphasized that these underlying sands are part of the Evangeline Aquifer, and should not be ignored with regard to groundwater monitoring.

#### **Response 86**

As discussed in Response 59, the Executive Director's review of the application indicates monitoring of Sand C, which underlies the production zone (Sand B), is not warranted for two reasons. First, the cross sections<sup>111</sup> and geophysical well logs<sup>112</sup> in the application indicate Sand B is underlain by a continuous shale layer that isolates Sand B from Sand C. Second, water levels in two wells completed in Sand C, RBLC-3 and RBLC-4, remained unchanged<sup>113</sup> during the PA-1 pump test, despite the fact that each well is within about 100 feet of PTW-1, which was pumped during this test.

#### **Comment 87**

GCGCD commented that the results of hydraulic testing may indicate the existence of hydraulic connection between the production zone within the production area and the production zone monitor wells, but these results provide no information on travel time of contaminants due to solute transport velocity.

#### **Response 87**

The purpose of the pump tests is to verify that there is a hydraulic connection in the production zone from the production area outwards to the monitor wells, and to demonstrate that there is no hydraulic connection between the production zone and nonproduction zone units. It is not the purpose of these tests to determine the solute transport velocity of various groundwater quality parameters. With regard to solute transport velocity, one desirable characteristic for an excursion indicator parameter is that it is conservative with respect to solute transport; it travels essentially at the rate of

<sup>111</sup> UEC PAA1 application, Figures 3-2 through 3-5a.

<sup>112</sup> UEC PAA1 application, Appendix C.

groundwater flow. The use of chlorides and conductivity as parameters will provide the earliest indication of an excursion.

#### **Comment 88**

GCGCD and Blackburn Carter (BC) commented that UEC is required to demonstrate that uranium mining solutions will be restricted to the production zone within the production area, and noted that GCGCD commissioned a groundwater modeling study that brings into question the confinement of mining solutions at the proposed site. GCGCD stated that UEC has not answered with a modeling study, and has proposed minimal groundwater modeling to detect the excursion of mining solutions.

#### **Response 88**

The Executive Director's review of UEC's PAA1 application indicates that all applicable regulatory requirements have been met. The presumes the comment refers to the study conducted by Daniel B. Stephens and Associates for GCGCD. A copy of this report was provided to the Executive Director's staff by the District at the January 24, 2008 TCEQ public meeting held in Goliad, Texas. The study involved a numerical simulation of the behavior of injected water into a zone that appears to be equivalent to Sand A, although the results of this study did indicate migration of injected fluids to a lower zone. As discussed in the Executive Director's Response to Public Comment on the Class III injection well area permit application, the Executive Director considers this study to be useful in a general sense, but notes the assumptions on which this modeling was based do not include site-specific conditions. Because of the general nature of this modeling, the Executive Director cannot conclude that groundwater in the four sands of the Goliad Formation at this site are in hydraulic communication.

UEC performed two pump tests at the site to determine the degree of hydraulic connection within the production zone (Sand B), and the degree of hydraulic connection between overlying Sand A and underlying Sand C. The results of those tests, presented in Section 4.0 and Appendix D of the application, indicate good hydraulic connection within Sand B and no hydraulic connection between Sand A and Sand B, or between Sand B and Sand C.

#### **Comment 89**

Richard Bettge commented that the PAA should require two monitor well rings around the production area. The first ring should be situated 400 feet from the production area and the second ring should be situated 400 feet beyond the first monitor well ring. Lynn and Ginger Cook commented that in addition to the proposed monitor well ring, there should be two more rings of monitor wells, placed 100 and 200 feet, respectively, from the edge of the production zone. The Cooks also commented that data from these inner monitor well rings should be made available to the GCGCD and to the TCEQ.

#### **Response 89**

The Executive Director reviewed UEC's PAA application and determined that it meets the requirements of 30 TAC §331.103 (Relating to Production Area Monitor Wells) for monitor well locations. Additionally, in response to the TCEQ's January 23, 2009 notice

of deficiency letter, UEC added two additional monitor wells along the southeast (downgradient) side of the proposed production area. These two additional wells, designated GW-1 and GW-2 are between the edge of the production area and the monitor well ring.<sup>114</sup> There are no rule requirements for a second monitor well ring surrounding the first ring of production zone monitor wells.

#### **Comment 90**

Richard Bettge commented that the PAA should require that the monitor wells be equipped with double locks so that the wells can only be sampled when both parties are present to split samples. Similarly, Roland Burrows asked if UEC will allow a double lock system so that a water board representative is present during sampling. Brenda Jo Hardt asked if the TCEQ could recommend some type of double lock system on the monitor wells, as such a system would not allow UEC to sample the wells unless the GCGCD was present. The Bettges emphasized that without independent testing and monitoring of the mining process, important quality control issues may be overlooked in the interest of reducing costs to increase profits.

#### **Response 90**

Although the Executive Director encourages operators to use appropriate measures such as locking well caps to secure monitor wells from tampering or the inadvertent introduction of contaminants, the Executive Director does not recommend double locks, with the purpose to deny the operator's access to the monitor well unless a representative from the GCGCD or the TCEQ is present. Monitor wells must be sampled a minimum of twice a month,<sup>115</sup> and TCEQ does not participate in routine groundwater sampling at this frequency. Furthermore, the Executive Director does not have the authority to grant permission to individuals to enter private property to take groundwater samples. If UEC obtains a radioactive materials license, UEC may be required to designate restricted areas where access is controlled to protect individuals from undue risks to exposure to radiation and radioactive materials. If licensed, UEC will also be required to implement controls to prevent access to certain areas by visitors as part of the radiation safety program.

#### **Comment 91**

Richard Bettge commented that each sand layer should be sampled in each monitor well.

#### **Response 91**

In accordance with the requirements at 30 TAC §331.103 (Relating to Production Area Monitor Wells), monitor wells must be installed and operated in the production zone and in all freshwater aquifers overlying the production zone. Although not specifically required by rule, the Executive Director, would, if necessary, require the installation and operation of monitor wells in sands underlying the production zone. However, the Executive Director does not agree that all sands within a production area should be sampled in each monitor well. The monitor wells are screened for a particular purpose. The production zone monitor wells are screened in the same sand layers in which production occurs because they are established to detect excursions of mining fluids

<sup>114</sup> See Figure 1-4 of UEC's PAA1 application.

<sup>115</sup> 30 TAC §331.103.



outward from the production area. The non-production zone monitor wells are screened in sand layers above the production zone to detect vertical migration of mining fluids. Sampling from each sand layer would thwart the intended function of the monitor well.

## N. CONTROL OF MIGRATION

### Comment 92

Robin Sherwood commented that Production Area 1 is within the Evangeline Aquifer, and that drawing lines on a map to exclude or avoid existing nearby wells in no way stops contaminants from migrating out of the production area. Ms. Sherwood emphasized that there are no barriers in the water flow of the Evangeline Aquifer; therefore UEC cannot control the movement of contaminants from the production area into adjacent parts of the aquifer. David and Carol Warren asked what will be done to insure mining fluids and by-products are not leaking into other water-bearing sands and that they do not migrate downdip within the production zone. The Warrens also asked who would be monitoring for migration of mining fluids from the production zone within the production area.

### Response 92

If the Class III injection well area permit and the PAA are issued, and if the aquifer exemption is approved by the EPA, UEC will be required to confine mining solutions within the area of designated monitor wells. Migration of mining fluids is controlled through well spacing and by withdrawing more groundwater than is injected. This results in the movement of groundwater from the injection wells to the production wells, preventing the injected fluids from migrating out of the production area. The natural characteristics of Sand B also will help prevent migration. Geologic information included in Section 3.0 (Production Area Geology and Hydrogeology) and in Section 4.0 (Hydrologic Testing) of UEC's PAA application, shows that Sand B is continuous across the mine area, and exhibits good hydrologic connection across the mine area. These characteristics enable UEC to more easily predict the movement of injected mining fluids and ensure that any excursions will be intercepted by monitor wells.

The oxidizing nature of the injected fluids results in uranium and other constituents being dissolved from the aquifer material. After mining is complete, the oxidizing environment created within the mined zone remains. Aquifer restoration will lower the level of oxidation within the mined zone, but oxidizing conditions may persist to some degree. Under these oxidizing conditions, certain constituents can occur in the groundwater in higher concentrations than would occur under reducing conditions. Outward from the mined zone, naturally-occurring reducing conditions will prevail. As groundwater migrates from the mined zone, it will encounter these reducing conditions, and the concentrations of the constituents dissolved in the groundwater will be reduced to background concentrations.

Finally, UEC will monitor the production zone (Sand B in this case) and overlying Sand A to detect the migration of any mining fluids from Sand B within the production area. If mining fluids are detected in any of these wells, the operator must, in accordance with the requirements of 30 TAC §331.106, take actions to confine the mining fluids to the

production zone within the production area. Possible actions that might be taken include increasing the amount of bleed water, or the installation of additional production wells in the area of the excursion. The purpose of both actions, either separately or together, is to induce groundwater to flow toward the production area, rather than outward from it. Once mining is complete, the aquifer must be restored in accordance with the requirements of 30 TAC §331.107.

#### **Comment 93**

GCGCD expressed the concern that a 1% bleed is grossly inadequate to control excursions and asked what science was used to verify that this level of bleed was adequate, based on local hydrology.

#### **Response 93**

The permittee is required to confine the mining solutions to the production zone within the production area. Maintaining a bleed is a method for containing the mining solutions to the production area. The Executive Director believes the proposed bleed rate is adequate to contain mining solutions. In addition, the permittee has financial incentive to contain mining solutions through well control and bleed to assure their recovery of the uranium. It is not in the permittee's interest for uranium that it could sell to be lost through excursions. A bleed is necessary to direct the mining fluids from each injection well to the production wells. The Executive Director is not aware of any specific conditions at the proposed site that would indicate a 1% bleed is inadequate for containing the injected mining fluids to Sand B within the production area. There are no specific regulatory requirements for an operator to maintain a bleed *at in situ* uranium mines in Texas, although a bleed of 1% typically has been used,<sup>116</sup> and the proposed Class III injection well area permit includes a requirement for UEC to maintain a bleed.<sup>117</sup>

#### **Comment 94**

GCGCD commented that UEC's assumption that pumping one percent more water within the mining area than is withdrawn ("bleed") will not necessarily result in hydraulic containment of the mining fluid. According to GCGCD, hydraulic capture is dependent on several factors, including well spacing, injection and pumping rates, hydraulic gradient, and local hydrogeologic conditions. GCGCD noted that UEC anticipates operating 192 wells in the production zone, but provided no information on well spacing, injection and pumping rates. GCGCD stated that multiple references are available that indicate a one percent bleed is the lowest value necessary to achieve containment, and that a bleed of three to five percent, or greater, may be required to achieve complete hydraulic containment of mining fluids. GCGCD further commented that the TCEQ should not simply accept a one percent bleed as being adequate for containment of mining fluids.

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<sup>116</sup> Kohler, D. P., 1984, *Underground Injection Operations in Texas*, Tex. Dept. Water Res., Report 291, page 4-8.

<sup>117</sup> Provision V.C.1, proposed UEC Class III injection well area permit.

#### Response 94

As discussed in Response 14, a bleed of one percent is typical for *in situ* uranium mining operations in South Texas,<sup>118</sup> although the Executive Director notes that a publication provided by Dr. Douglas Blanford refers to a bleed of five percent.<sup>119</sup> TCEQ regulations that apply to *in situ* mining do not address the amount of bleed water produced at a facility. An operator is required to confine mining fluids to the production zone within the area of designated production zone monitoring wells,<sup>120</sup> and this is accomplished in part by maintaining a bleed. If a one percent bleed is insufficient, then UEC will have to adjust the bleed. UEC provided an estimate of the number of injection and production wells that will be needed to mine the uranium mineralization in the proposed production area in order to provide an estimate of plugging and abandonment costs as is required under 30 TAC §331.143. This estimate is used to determine the amount of financial security that UEC must provide for plugging and abandonment of wells, as required under 30 TAC §331.109(b).

#### Comment 95

According to GCGCD, UEC's proposed method for determining an upper control limit for each of the two proposed indicator parameters, electrical conductivity and chlorides, which is to multiply the highest value by 1.25, is inappropriate in that it will allow for a significant amount of groundwater degradation outside the production area prior to determination of the presence of an excursion. GCGCD stated that this method is particularly egregious for monitoring in Sand A, for which UEC has proposed an upper control limit of 730 mg/l for chlorides. GCGCD expressed the opinion that these values for upper control limits will not result in effective and timely detection of an excursion, as is required by regulation.

#### Response 95

The method used by UEC, which is to take the highest value of the control parameter and multiply it by some factor is one of the methods suggested by the NRC.<sup>121</sup> Once established, this value is used throughout the duration of required monitoring; it is never recalculated. UEC multiplied the highest chloride value, 584 mg/l by 1.25 for an upper control limit of 730 mg/l for Sand A. Available historical data indicate that for chlorides and conductivity, this method (1.25 x highest value) has been successful in detecting excursions at South Texas *in situ* uranium mining sites. The Executive Director determined the proposed control parameters meet the requirements of 30 TAC §331.104.

#### Comment 96

Richard Bettge commented that the PAA should include a requirement to balance the flows of injection rates and that such balancing should be on a "lateral by lateral" basis rather than a balance of the total mine.

<sup>118</sup> Kohler, D. P., 1984, *Underground Injection Operations in Texas*, Tex. Dept. Water Res., Report 291, page 4-8.

<sup>119</sup> Blanford, Douglas, 2007, *Uranium—Is the Next Boom Beginning?*, New Mexico Earth Matters.

<sup>120</sup> 30 TAC §331.102.

<sup>121</sup> NRC, 2003, NUREG-1569, page 5-41.

**Response 96**

The Executive Director presumes the commenter uses the term "lateral" to refer to the piping that can connect several injection wells to the main feed line from the processing plant, or to the piping that can connect several production wells to the main line going to the processing plant. The Executive Director notes that UEC is not allowed to operate the injection and production wells "in balance." In accordance with the requirements in Provision V.C. of the draft Class III injection well area permit, UEC is required to withdraw more water than is injected, rather than to operate the system in balance (that is, so that the injection rate equals the withdrawal rate).

**Comment 97**

Roland Burrows asked if monitor wells would be sampled properly.

**Response 97**

The draft Class III injection well area permit includes requirements<sup>122</sup> to ensure wells are sampled properly. Under provision V.F. of the draft Class III UIC area permit, prior to sampling, each well must be purged until the produced water is free of mud and foreign material and conductivity and pH have stabilized, and sample preservation, analysis, and analytical quality control must be in accordance with approved EPA methods.

**O. SPILL AND EXCURSION RESPONSE AND CLEANUP****Comment 98**

Ted Long asked what improvements have been made to the pipes and adhesives used for above-ground piping, to prevent spills. He also asked what examples of these improvements guarantee no lines will ever break or be broken, resulting in a spill.

**Response 98**

The materials used for the above-ground piping are addressed in the application for a radioactive materials license, which UEC has submitted and currently is under technical review. The license application indicates that the well field trunk lines are to be constructed of 8 to 10-inch diameter high density polyethylene (HDPE) pipe. Joints in the HDPE lines are fusion welded, and no adhesives are utilized. This construction is standard practice in facility design and has been approved at other facilities that use corrosion-resistant pressure pipe. Spill prevention and spill response also are addressed in the license application. The purpose of the requirements for pipe design and facility operations is to prevent spills and to minimize the effects of a spill when one occurs. However, the Executive Director cannot guarantee that a spill will not occur.

**Comment 99**

Ted Long asked how an above-ground spill would affect Coleta Creek, which is the natural habitat of the bald eagle, fish, and other wildlife.

<sup>122</sup> Draft UEC Class III UIC area permit, provision V.F.

#### **Response 99**

Spill response is addressed in the application for a radioactive material license. UEC has submitted an application for a license, and the application is under technical review. In general, all spills must be addressed immediately to prevent damage to the environment.

*In situ* uranium processing facilities are designed and managed to prevent release of materials to the environment. At UEC's proposed facility, all liquids, including chemical and mining fluids, will be managed in tanks. The entire processing area will be built on a concrete pad, with curbing and sumps to contain leaks and spills.

### **P. CONTAMINATION OF SURFACE WATER, AIR, AND SOIL**

#### **Comment 100**

Thomas and Mary Anklam expressed the concern that uranium mining will result in pollution of the air, water, and soil. They noted that the land in the vicinity of UEC's proposed site has a gentle slope, and surface water will flow from the uranium exploration area into nearby creeks. Richard and Catherine Bettge commented that their property extends to Coleta Creek, which they use to water their livestock. The Bettges expressed concern that contamination of this creek by mining and restoration activities may result in health problems for them, their cattle and for wildlife. David and Carol Warren asked what can be done to stop surface contamination before it spreads. They also asked who would monitor surface contamination.

#### **Response 100**

The PAA, if issued, would not authorize any discharge of waste to surface waters. Issues related to runoff from exploration activities are regulated by the Railroad Commission of Texas, not the TCEQ. However, the Executive Director recognizes that the proposed mining area is in the watershed of Coleta Creek, and that surface contamination anywhere within this watershed could be transported by runoff to Coleta Creek. Potential surface contamination associated with mining activities at the site would be from spills of mining fluids or wastewaters at the processing plant from one of the proposed Class I injection wells. Requirements for containment of these fluids are addressed in the radioactive materials license. Requirements for any units used to store wastewater prior to injection that are not regulated under the license would be addressed in the Class I well permit. Generally, the occurrence of spills is minimized through design and operating requirements that apply to the processing facility and units authorized under a Class I well permit. Spills may occur, however, and therefore these design requirements include secondary containment, such as curbing and sumps to capture spilled fluids before they can be introduced into the environment.

The Executive Director is aware that the RRC investigated UEC's exploration drilling activity in regards to surface gamma radiation. It is the Executive Director's understanding that this gamma ray radiation was due to uncovered drill cuttings, and that the matter was addressed to the satisfaction of the RRC. This gamma radiation most likely was from the presence in the drill cuttings of various daughter products from the decay of uranium.

Surface monitoring is addressed in the Radioactive Materials License application. UEC has submitted a license application to the TCEQ; this application presently is under technical review. The license would establish the requirements for inspection of retention systems by the company and the requirements for reporting and remediation of spills.

#### **Comment 101**

The Bettges expressed concern that airborne contaminants from the site would be carried to their property by southeast prevailing winds. Richard Bettge commented that radon levels should be monitored at the processing plant. Roland Burrows asked if radon monitors would be installed and operated at the proposed processing plant. Gene and Reta Brown expressed concern about the release of radon gas from the processing facility, which could travel to their property. Brenda Jo Hardt stated that southeast winds from UEC's production area will substantially increase levels of cancer-causing radon in the air. Ted Long asked what baseline air quality sampling in the area will be done prior to mining, and how will air quality requirements be enforced.

#### **Response 101**

The Underground Injection Control program rules for *in situ* mining do not address air emissions. A permit-by-rule (#86882) that authorizes emissions from the proposed facility was issued to UEC on January 15, 2009. UEC has submitted an application for a radioactive materials license for this site, and this application currently is under technical review. Worker and public exposure to radon or other sources of radioactivity are addressed under the radioactive materials license, which limits the dose from radon and other sources of radiation to 5 rem per year for occupational exposure and 100 millirems for individual members of the public. The license would also address radon and radiation monitoring requirements.

#### **Comment 102**

Blackburn Carter (BC) noted that the downgradient boundary of the proposed mine site is circumscribed by Fifteen and Eighteen Mile creeks. Given this situation, BC expressed the opinion that the PAA application and the Class III UIC area permit application should fully characterize the interaction of the surface water in these creeks with the Goliad sediments within the site area. BC emphasized that this characterization should include detailed information about faults at the site with respect to the proposed PAA. BC also stated the streams, faults, active mining process, and proposed restoration process should be modeled using a comprehensive scenario matrix.

#### **Response 102**

The Executive Director reviewed the contents of the application to determine their compliance with the applicable state laws and rules. There are no provisions that require the applicant to characterize interaction with surface waters. Protection of surface waters is subsumed in the requirement to confine mining solutions to the production zone.<sup>123</sup> The Executive Director found that the application meets the rule requirements.

The Executive Director does not agree that there is interaction between Sand B, which contains the proposed production zone for Production Area 1 and Fifteenmile and Eighteenmile creeks, for several reasons. First, both of these creeks are represented as intermittent streams on the USGS topographic quadrangle map that includes the area of the proposed UEC site (see the Ander, Texas USGS Topographic Quadrangle Map, 1963)—that is to say, they do not flow throughout the year. Second, regional groundwater flow is to the southeast, which places Fifteenmile Creek hydraulically upgradient of the site. Third, within the graben area, where the Sand B orebody in the production area is located, Sand B does not crop out at the surface. Fourth, Sand B does not intercept the channel of Eighteenmile Creek, which is south of the site. At the proposed production area, the top of Sand B is at a depth of about 152 feet from the surface.<sup>124</sup> The maximum surface elevation at the proposed site is about 245 feet above sea level, placing the top of Sand B at an elevation of about 93 feet above sea level at the proposed production area. The lowest elevation of the Eighteenmile Creek channel south (downgradient) of the proposed production area is about 150 feet above sea level. Groundwater in the production zone in Sand B would not migrate upward to meet the lowest elevation of Eighteenmile Creek.

#### **Q. RESTORATION OF THE AQUIFER: FEASIBILITY AND ENFORCEMENT**

##### **Comment 103**

CBGSC asked what assurance there is that UEC's restoration efforts at PAA1 will be more successful than the almost total failure of past restoration efforts in other Texas counties. Joan Fabian, Jacqueline Fonseca, Carol Fulton, Veronica Galvan, Cheri Hart, Donna Hoffman, Lois Huff, Kenneth Izumi, Steven G. Kellman, Barbara Allen-Lampley, Judy Landress, Philip LeMessurier, Kathy B. Newman, Wayne Owens, Catherine Schneider, Ed Sonnen, Mark Sprinkle, Rebecca Sprinkle, Ryan Sprinkle, Mobi Warren, Kelli Wilder, and Paul Fitzpatrick requested that the TCEQ deny UEC's application for PAA1 because the uranium mining industry has consistently failed to restore groundwater to pre-mining quality in areas of south Texas where *in situ* mining for uranium has occurred. Richard and Catherine Bettge commented that groundwater quality and quantity will not be restored to baseline levels after mining is complete. Paul Fitzpatrick commented the groundwater in the area to be mined will be contaminated and never cleaned up. Vicky Gutmann commented that uranium companies have not cleaned up mining sites in the past and have shown no indication they will conduct their operations differently in the future. Ms. Gutmann emphasized that uranium mining companies in the past always requested variances from aquifer restoration requirements, and that these variances were granted by the TCEQ. Ronnie Primrose stated that it is a well-known fact, recognized by the uranium mining industry, that it is impossible to return the groundwater in the mined aquifer to pre-mining quality, or even to a usable quality. Cyrus Reed of the Lone Star Chapter of the Sierra Club commented that many members of this organization are concerned about the proposed PAA because of the historical lack of success by the uranium mining industry in restoring groundwater quality in the mined aquifers to their pre-mining quality. Mr. and Mrs. Manfred

<sup>124</sup> UEC PAA1 application, page 3-3.

Scheurich expressed the concern that the mining industry historically has been unable to restore the groundwater in mined areas to its pre-mining quality. David and Carol Warren stated that it is a well known fact, admitted by the uranium industry, that it is impossible to restore the groundwater in a mined aquifer to its pre-mining quality, or even to a usable quality, which results in large amounts of water being ruined for generations. Richard Bettge commented that pre-mining levels should be strictly enforced for groundwater restoration and that no variance should be allowed. Ted Long stated that the TCEQ has relaxed restoration standards in the past, and asked if the TCEQ will do so again for UEC.

### Response 103

The Executive Director acknowledges that that mining companies have rarely succeeded in restoring groundwater in mined aquifers to pre-mining conditions, and that the commission has approved amendments to restoration values of production area authorizations for various constituents and parameters in the groundwater; however, the Executive Director does not agree that restoration efforts at other *in situ* uranium mining operation in Texas have been a failure. Data from aquifer restoration efforts at other *in situ* mining operations in South Texas confirm that restoration to determined pre-mining groundwater conditions for all constituents and parameters has been achieved at one production area on one of these sites. Restoration efforts at all other sites improved groundwater quality by lowering the concentrations of constituents and have reduced the radioactivity associated with radionuclides in the groundwater, but not all were lowered to pre-mining levels, despite continued efforts by site operators. Eventually, at each of these sites, a decision had to be made as to whether continued restoration efforts (and continued energy and water use) justified small improvements in water quality within the portion of the aquifer being restored.

The Executive Director cannot provide absolute assurance that UEC's restoration efforts will result in restoring the groundwater in Sand B within the proposed production area to the established pre-mining quality for all constituents listed in the PAA restoration table. However, the Executive Director anticipates restoration will exceed historical results for three reasons. First, recent rule changes<sup>125</sup> will result in better estimates of pre-mining groundwater quality to begin with. Under 30 TAC §331.104(c), baseline must be based on a minimum of five wells or one well for every four acres of production area, whichever is greater. Prior to the rule changes, a minimum of five baseline wells was required. UEC is basing pre-mining groundwater quality on data from 18 baseline wells. Also, pre-mining groundwater quality now must be based on data from wells completed in the production zone within the production area. Under the previous rules, baseline for each constituent was the larger average value from either the baseline wells or the monitor wells. Second, reverse osmosis, which is used to remove contaminants from the groundwater, will be used both during mining and during restoration. By using reverse osmosis during mining, UEC will limit the increase in concentration of contaminants as mining progresses, rather than allowing them to increase until restoration is initiated. Third, UEC has stated that restoration will begin as soon as hydraulic separation can be established between the mined portion of an aquifer and the portion that is currently



being mined, rather than waiting until the entire production area has been mined.<sup>126</sup> By beginning restoration as soon as possible, UEC will have more time to evaluate and, if necessary, adjust restoration methods.

The Executive Director does not agree that allowing amendments to restoration tables has ruined large amounts of groundwater for future generations. Based on the historical data referenced above, the pre-mining water quality in all of the uranium production areas approved in Texas did not meet primary drinking water standards.

Restoration table values have been amended by the TCEQ pursuant to an application to amend the production area authorization through the process established in 30 TAC §331.107(g)(1) and (2). An application to amend the restoration table values of a PAA is subject to public notice, opportunity to provide public comment, and an opportunity to request a contested case hearing.

#### **Comment 104**

David and Carol Warren asked what can be done to clean up the aquifer. They also asked what assurances there are that a mining company will clean up a site and restore the aquifer once mining is complete. They further asked how clean-up can be enforced, and how they can be assured that groundwater standards will not be lowered, allowing a mining company to avoid clean-up, as the TCEQ has done in the past.

#### **Response 104**

Once mining is complete, the operator is required to restore the groundwater in the mined portion of the aquifer to its pre-mining quality.<sup>127</sup> Also, the operator is required to provide financial assurance for restoring the affected groundwater to its pre-mining quality. PAA1 includes a cost estimate of \$1,934,742 (in 2009 dollars) for the cost of restoring the groundwater in the production area. As a condition of the radioactive material license, the operator must provide funds sufficient for aquifer restoration in an acceptable financial assurance mechanism. In the event the operator does not restore the aquifer in accordance with the applicable regulations, the TCEQ can use these funds to restore the aquifer.

Methods for restoring a mined aquifer include groundwater sweep, groundwater replacement, pump-and-treat, injection of reducing agents, and bioremediation. Groundwater sweep involves pumping water from the mined zone, thereby allowing unaffected groundwater in the area surrounding the mined portion of the aquifer to flow into the mined area, replacing the affected water. Groundwater replacement is similar, except the removed affected water is replaced by injecting unaffected water from another mineralized, yet unmined portion of the aquifer. With pump-and-treat, the affected groundwater is pumped to the surface, treated to remove contaminants, usually using reverse osmosis, and then re-injected. All three of these methods have been used with varying success. Pump-and-treat is preferable because it results in the disposal of significantly less water. The other two methods, injection of reducing agents and

<sup>126</sup> UEC Class III UIC well application, page 8-1.

<sup>127</sup> 30 TAC §331.107.

bioremediation, are experimental and have not been used in Texas. The assumption with injecting reducing agents (such as hydrogen sulfide) is that these agents will cause the contaminants to precipitate from the groundwater and become immobilized. In bioremediation, nutrients are injected into the mined zone to promote increases in the naturally-occurring bacteria populations. The resultant increase in bacteria results in a decrease in the concentration of metals in the groundwater, although the exact mechanism is not understood.<sup>128</sup>

The TCEQ has allowed mining companies to amend their restoration tables to raise the restoration values for certain constituents. With the exception of one production area authorization,<sup>129</sup> restoration tables of all other production area authorizations have been amended. In reviewing a request for amendment to a restoration table the TCEQ must consider factors in 30 TAC §331.107(g)(1) such as efforts made to restore the groundwater, costs of further effort, consumption of groundwater resources during further restoration, and the uses for which the groundwater is suitable. To allow an amendment, the TCEQ must find that reasonable efforts have been undertaken, the groundwater would be suitable for any use to which it was reasonably suited prior to mining, and that further restoration efforts would consume energy, water, or other natural resources without providing a corresponding benefit. An amendment to a restoration table is a major amendment,<sup>130</sup> and is subject to public notice, opportunity for public comment, and opportunity for a contested case hearing. Amendments to restoration tables have been approved only after careful consideration of the factors and requirements cited above.

#### **Comment 105**

GCGCD noted that in the February 19, 2009 response to TCEQ's notice of deficiency letter, UEC stated that a flare factor of 1.5 was used in evaluating the proposed facility's fluid handling capacity, but that on page 8-8 of the application, a flare factor of 1.875 was used. GCGCD asked what science was used to establish the flare factor.

#### **Response 105**

Flare factor is an estimation of a volume of water that extends in the production zone beyond the production area used for estimating volumes of water required for aquifer restoration. From UEC's application materials, it appears that two different flare factors were used for estimating fluid handling capacity and for calculating the cost estimation for aquifer restoration. The 1.875 flare factor used by UEC reflected in the cost estimate for aquifer restoration is within the general range accepted for the Goliad Formation in South Texas. The Executive Director recommends that the same flare factor be used for estimating fluid handling capacity and for calculating the cost estimation for aquifer restoration. Neither the draft Class III injection well area permit nor the draft PAA establishes a limit for fluid handling capacity.

<sup>128</sup> Hall, S., 2009, *Groundwater Restoration at Uranium In-situ Recovery Mines, South Texas Coastal Plain*, USGS Open-File Report 2009-1143, page 29.

<sup>129</sup> O'Hearn Mine, Production Area Authorization 01941-031.

<sup>130</sup> 30 TAC §331.107(g)(1).

#### **Comment 106**

GCGCD commented that the pore volume calculated did not include the entire thickness of Sand B, and asked what science was used to support exclusion of a portion of the Sand B from the pore volume calculation. GCGCD noted that UEC provided no modeling to predict the impact to water levels in the area, and stated that modeling is required for design assumptions for potentially higher remediation requirements. GCGCD also asked what science was used to derive six pore volumes for restoration, what is the contingency plan if more than six volumes are required, and does UEC have sufficient fluid capacity to handle such a contingency.

#### **Response 106**

The pore volumes used by UEC take into account the thickness of Sand B that will be affected by *in situ* mining, with an included a flare factor. In evaluating UEC's assumption of six pore volumes for restoration, the Executive Director took into consideration that restoration will begin as soon as hydraulic separation can be established between the mined portion of the aquifer and the portion that is currently being mined, and that prior to reinjection, mining fluids will be treated using reverse osmosis to reduce the level of constituents or other parameters in the mining fluid.<sup>131</sup> Based on these considerations, the Executive Director accepts the assumption of six pore volumes for aquifer restoration as reasonable. This estimate is used for planning projected water use to ensure the mine operation is designed with sufficient disposal capacity and for cost estimates to establish required financial assurance amounts. Groundwater must be restored in accordance with the requirements of 30 TAC §331.017 regardless of the number of pore volumes it may actually take to achieve restoration. Also, these estimates include a twenty percent contingency over the specific estimated costs.

In Section 12 of their Class III UIC area permit application, UEC committed to provide a restoration demonstration within 18 months of the beginning of *in situ* operations. Should the results of this demonstration indicate the assumed number of pore volumes required for aquifer restoration is inadequate, the Executive Director would require the amount of financial assurance for aquifer restoration to be adjusted accordingly. In addition, under 30 TAC §331.143 a permittee is required to provide an annual update to the cost estimate of the cost of aquifer restoration to account for changes in costs. Should UEC discover new costs, such as an increase in the number of pore volumes needed to restore the aquifer, UEC would need to update the cost estimate and provide additional financial assurance.

#### **Comment 107**

GCGCD expressed the concern that insufficient water was allotted per pore volume and that more than six pore volumes will be required to achieve an acceptable restoration. GCGCD advocated the necessity of a water management plan to determine the groundwater availability threshold before harm is done to the public water supply users. GCGCD also commented that the availability of water must be verified before any

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<sup>131</sup> UEC Class III UIC area permit application, page 8-1.

mining begins, as adequate quantities of groundwater may not be available for unpredicted remediation requirements.

#### Response 107

As discussed in Response 108, the Executive Director accepts UEC's estimate of the number of pore volumes required for restoration as reasonable. There are no regulatory requirements for an *in situ* uranium mine operator to have a water management plan to determine water availability.

#### Comment 108

James Williams commented that the use of reverse osmosis during aquifer restoration has not proven to be sufficiently effective in removing contaminants to restore affected groundwater to baseline water quality. He noted that research is being conducted that involves the introduction of reducing agents to the affected groundwater and asked the following questions:

1. How extensive are field tests using this technology?
2. What mining companies and in what locations is this method being tested?
3. How long has this method been used in the field?
4. What universities and scientists, in addition to Dr. Lee Clap at Texas A&M University in Kingsville, Texas, presently are doing laboratory research on the effectiveness of this method?

#### Response 108

UEC has not proposed to introduce reducing agents for aquifer restoration under the proposed Class III injection well area permit or PAA1 applications. Dr. Susan Hall with the United States Geological Survey in Denver, Colorado, provided a summary of the results of chemical reduction research.<sup>132</sup> According to Dr. Hall, the results are mixed regarding the use of chemical reductants to reverse the effects of oxidizing lixiviant solutions at *in situ* uranium mining sites. Dr. Hall provided the following information in this open-file report:

Type of Reductant	Sites	Pros	Cons
Hydrogen Sulfide	Smith Ranch, Wyo. Irigaray, Wyo. Collins Draw, Wyo. Crown Point, NM	Good reducer	Volatile, difficult to use, Well clogging
Sodium Sulfide	Crown Point, NM Highland, Wyo.	Less expensive than bioremediation	Overall mixed results, insufficient reducing capacity, may produce transitory effects

<sup>132</sup> Hall, Susan, 2009, *Groundwater Restoration at Uranium In-situ Recovery Mines, South Texas Coastal Plain*, UEC's Open File Report 2009-1142, page 28.

Hydrogen Gas	Kingsville Dome, TX	Good reducer	2009 pilot project-results not available
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The Kingsville Dome site is managed by URI, Inc. Dr. Kim Jones of Texas A&M University has been conducting research on *in situ* uranium mining, including investigation of adding reductants to the mined zone to aid in aquifer restoration.<sup>133</sup>

## R. FINANCIAL ASSURANCE

### Comment 109

Richard Bettge commented that a cleanup fund of \$45 million should be established before any mining occurs. Raymond and Karon Arnold asked if a dedicated fund has been established to reimburse property owners for drilling and completing deeper water wells in the event UEC's mining operations result in the lowering of water levels to the extent water wells in the area go dry. The Arnolds also inquired, if such a fund has not been established, whether the TCEQ will require UEC to establish such a fund. John Caldwell stated that the potential for permanent and irreversible damage presented by the proposed mining operation warrants the establishment of an escrow account. Mr. Caldwell noted that such account has not been established. Gene and Reta Brown asked if a mining company is legally responsible for any damage they cause to other people's property or standard of living, and if sufficient bonding is in place to address cleanup of the site and any damages they may cause to surrounding property. Ted Long asked if UEC has provided funds for aquifer restoration. He also asked if these funds would be available prior to commencement of mining. Mr. Long further asked if a mitigation fund has been established to compensate landowners for damages they may incur from mining. Mr. Long inquired how large this fund was, and for what period of time it would exist. David and Carol Warren asked how citizens can be assured the mining company will financially settle any damages.

### Response 109

Operators of *in situ* mining operations must provide financial assurance for plugging and abandonment of wells and for aquifer restoration in accordance with the requirements in 30 TAC §§37.7021 and 37.9045(b), respectively. Additional financial assurance is required under the radioactive materials license for decommissioning of the surface facilities. Financial assurance sets aside funds available to the TCEQ to perform well plugging, aquifer restoration, and decommissioning should the permittee fail to do so. PAA1 provides cost estimates of \$1,934,742 (in 2009 dollars) for aquifer restoration and \$173,519 for the plugging and abandonment of the injection wells, production wells, monitor wells and baseline wells. Financial assurance must be established prior to the commencement of mining. The permittee must review the cost estimates annually and increase the amount of financial assurance, if necessary. However, the TCEQ has no authority to impose a requirement to establish a remediation fund or a fund for replacement of private water wells for the benefit of third parties.

<sup>133</sup> Jones, Kim, 2006, *ISL Uranium Mining: Technological Advances and Challenges*, presentation at Uranium Information at Goliad Conference, September 21, 2006, Goliad, Texas

A permittee may be subject to civil liability for damages caused to residents or landowners. The draft permit specifically provides that the permit does not authorize any injury to persons or property or an invasion of other property rights, or any infringement of state or local law or regulations.<sup>134</sup> The TCEQ does not have jurisdiction over the award of civil damages from injury to persons or property and cannot establish remedies that may be available to an injured person should a corporation dissolve or otherwise cease to exist.

## **S. ENFORCEMENT: INSPECTIONS AND PENALTIES**

### **Comment 110**

Ronnie Primrose commented that the TCEQ lacks the power to enforce meaningful penalties on mining companies that contaminate the environment or otherwise cause damage. Ronnie Primrose further stated that this lack of control by the TCEQ allows the mining company to destroy, with impunity, the environment and people's quality of life. David and Carol Warren commented that inadequate regulations and lack of power to enforce meaningful penalties for contamination and damages allows the mining industry to destroy the environment and quality of life without any consequences. The Warrens also asked who will enforce the regulations, and whether penalties will be severe enough to deter noncompliance. They also asked what punitive damages can be assessed in the event of surface contamination, and who decides what has been damaged. They also asked what protection surrounding landowners have. Richard Bettge commented that penalties for violations should be established and stipulated before any mining activity occurs. Ted Long asked what the TCEQ will do to monitor and enforce regulations.

### **Response 110**

If the permits are issued, the TCEQ has the authority to enforce the provisions of the Class III injection well area permit, production area authorizations, and the Radioactive Materials License. Additionally, the TCEQ can enforce all applicable statutes and regulations.

In the event of a violation, TCEQ may issue an enforcement order, under which the operator would be required to pay a fine and, if appropriate, conduct corrective action to bring the facility into compliance with all permits, regulations, and statutes. The TCEQ may seek administrative penalties of up to \$10,000 a day for each violation and civil penalties up to \$25,000 a day for each violation.<sup>135</sup> If the permittee fails to remit the fine imposed, the case is referred to the Texas Office of the Attorney General for collection. Failure to comply with an ordering provision for corrective action is an independent violation and can result in additional enforcement actions at the TCEQ. Also, the TCEQ can refer a case to the Office of the Attorney General, who may pursue an injunction to require the permittee to perform the corrective action in the TCEQ enforcement order.

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<sup>134</sup> UEC draft Class III UIC area permit, Provision VII.F.

<sup>135</sup> Tex. Water Code 887.052, 7.101

The amount of the fine imposed in an enforcement case is determined by using the TCEQ Penalty Policy in force at the time the violation is screened by TCEQ Enforcement Division. The current Penalty Policy is available to the public on TCEQ's website at [http://www.tceq.state.tx.us/comm\\_exec/forms\\_pubs/rg/rg-253](http://www.tceq.state.tx.us/comm_exec/forms_pubs/rg/rg-253).

In addition to administrative penalties, a person may also be subject to criminal liability for knowingly or intentionally violating a requirement of the Injection Well Act, a TCEQ rule, or a TCEQ permit.<sup>136</sup>

#### **Comment 111**

John Caldwell commented that UEC's violations of its exploration permit with the Railroad Commission should be considered. He also stated that because UEC has a history of violations and its advertisements often contain statements that are untrue, the company inspires little confidence.

#### **Response 111**

Texas Water Code §27.051 requires the commission to find that the use or installation of an injection well is in the public interest prior to granting an application.<sup>137</sup> In determining whether the well is in the public interest, the commission must consider the compliance history of the applicant and related entities.<sup>138</sup> As required by statute, the commission has established a procedure for the preparation of comprehensive summaries of an applicant's compliance history, including the compliance history of any corporation or business entity managed, owned, or otherwise closely related to an applicant.<sup>139</sup> The commission's compliance history rules are in 30 Texas Administrative Code Chapter 60. The compliance period that is reviewed consists of the five years prior to the date the application is received.<sup>140</sup> The components of the compliance history are specified in statute and rules and include any final enforcement orders, court judgments, consent decrees, and criminal convictions of this state and the federal government relating to compliance with applicable legal requirements under the jurisdiction of the commission or the EPA.<sup>141</sup> UEC's compliance score is 3.01 (average by default). Under the current rules, the compliance history does not include information related to compliance with legal requirements under the jurisdiction of another state agency, such as the Railroad Commission of Texas. Therefore, the Executive Director is not authorized to consider the applicant's compliance history with the Texas Railroad Commission as part of the review of the PAA application. Because the Class III injection well area permit and PAA application are subject to a contested case hearing, any party may offer evidence on UEC's compliance history.

The Executive Director notes that the TCEQ does not regulate a company's press releases, nor does the Executive Director's staff review press releases.

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<sup>136</sup> Tex. Water Code §7.157.

<sup>137</sup> Tex. Water Code §27.051(a)(1).

<sup>138</sup> Tex. Water Code §27.051(d)(1).

<sup>139</sup> Tex. Water Code §27.051(e).

<sup>140</sup> 30 TAC §60(b).

<sup>141</sup> Tex. Water Code §5.753(b)(1), 30 TAC §60(c).

**Comment 112**

Roland Burrows asked if the TCEQ will publish procedures for reporting violations, and if the TCEQ will keep the public informed regarding the extent of each violation and actions taken by the TCEQ and the company to address any violations.

**Response 112**

The TCEQ is available 24 hours a day to receive complaints under the TCEQ's jurisdiction. Members of the public may submit complaints about a regulated entity and may inquire about violations and enforcement activities at this site by contacting the TCEQ at 1-888-777-3186.

**Comment 113**

Gene and Reta Brown asked if the TCEQ has sufficient manpower to adequately monitor and inspect the mining operation on a daily basis. Brenda Jo Hardt asked if the TCEQ had determined how often this site will be inspected, and also asked if the TCEQ regional offices rotate inspectors, and if inspections are unannounced.

**Response 113**

The TCEQ does have sufficient personnel to inspect *in-situ* uranium mining sites. The TCEQ does not visit sites on a daily basis, nor does the agency consider daily inspections to be necessary. These types of facilities generally are inspected at least once a year. All citizen complaints and concerns are investigated. TCEQ personnel who inspect these sites are based at TCEQ headquarters in Austin, under the agency's Office of Compliance and Enforcement or from the Corpus Christi regional office. Inspections can be announced or unannounced. Generally, periodic inspections are announced and inspections in response to complaints are not.

**Comment 114**

Ted Long commented that through the TCEQ, he is a licensed irrigator, but the TCEQ has never inspected any irrigation systems he has installed. He asked if the same lack of enforcement will be characteristic for UEC's proposed site.

**Response 114**

Although the TCEQ is responsible for issuing licenses pertaining to irrigators,<sup>142</sup> the agency does not conduct inspections of installed irrigation systems. Inspections of irrigation systems are done by municipalities or other providers of water, such as municipal utility districts.

**Comment 115**

The Arnolds requested that the TCEQ work with Goliad County and GCGCD to assure the provisions of PAA1 allow their enforcement by the GCGCD.

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<sup>142</sup> See 30 TAC Chapter 30, Subchapter D (Relating to landscape irrigation installers, irrigation technicians and irrigation inspectors)



### **Response 115**

The provisions of the draft PAA are based on regulatory requirements for which the TCEQ has jurisdiction. The TCEQ does not have the power to authorize another government agency to enforce permit or PAA provisions.

## **T. AQUIFER TESTING**

### **Comment 116**

GCGCD noted that Sand B is about 40 to 50 feet thick, based on the cross sections provided in the application, but screen lengths in the test and monitor wells vary from five to 20 feet. GCGCD contended that Sand B should be screened over its entire length to obtain unbiased data, and that the TCEQ raised this issue in their January 23, 2009 Notice of Deficiency (NOD) letter to UEC.

### **Response 116**

This NOD item was in reference to the analysis of the pump test data. The Executive Director's staff noted that the pumping wells for the two aquifer tests (wells PTW-1 and PTW-6, respectively) were not screened over the entire thickness of Sand B. The three methods<sup>143</sup> used to analyze the pump test data are based on the assumption that the aquifer is fully screened. In the NOD letter, staff requested UEC to revise the application to include a discussion on how this situation was addressed in the pump test analyses. In their February 19, 2009 response to the NOD letter, UEC stated that the software program<sup>144</sup> used to evaluate the pump test data accounts for partially screened wells and that the effect of partially-screened wells was negligible. This explanation meets the Executive Director's request for additional information.

### **Comment 117**

GCGCD commented that Section 4.0 (Hydrologic Testing) of UEC's application lacked data on the hydrologic characteristics of site. GCGCD noted the following deficiencies:

1. No information regarding characterization of the subsurface materials, such as grain size analysis, permeability range, effective porosity, cation-exchange capacity, organic carbon content, ex-ray diffraction data, or a determination of Atterberg limits;
2. No narrative and graphical presentation of the conceptual model;
3. No scientific basis for the location of the overlying monitoring wells in Sand A, or justification for the length of the pump test (GCGCD asked whether a different location for the monitor wells in Sand A and a longer test would indicate connectivity between Sand A and Sand B);
4. Transmissivity range is not discussed with respect to variation in fluid flow parallel and perpendicular to the fabric of the sediments; and

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<sup>143</sup> Theis, Theis (Recovery), and Cooper-Jacobs methods.

<sup>144</sup> Duffield, G. M., 2007, AQTESOLV for Windows, Version 4.50 Professional, Hydrosolv, Inc., Reston, VA.

5. No location of the no-flow boundary (Section 4.3.1) and its impact on mining operations and monitoring wells.

#### **Response 117**

The Executive Director emphasizes that the purpose of aquifer testing is to determine the degree of hydraulic connection in the proposed injection zone (in this case, Sand B), the degree of connection between the injection zone with overlying, and, in some cases, underlying aquifers, and to identify any hydrologic boundaries. To provide guidance to an applicant, the commission has compiled a guideline for aquifer testing.<sup>145</sup> The staff's review of Section 4 of UEC's PAA1 application indicates these guidelines were followed.

The Executive Director recognizes that the analyses listed by GCGCD would provide additional information regarding the nature of Sand B. However, these analyses are not required for demonstrating the hydraulic connectivity within Sand B or between Sand B and other aquifers. An aquifer test, as conducted by UEC, is a physical test that measures this connectivity (or lack of it).

The Executive Director finds the narrative provided in Section 4.0 of the application to be acceptable and compliant with all applicable statutes and rules. With regard to the location of monitor wells in Sand A, the Executive Director notes that these wells will also serve as nonproduction zone monitor wells, which are required under 30 TAC §331.103(b). The pump test information was used to confirm the suitability of the production zone monitoring and non-production zone monitoring and to assure that mining fluids can be confined.

#### **Comment 118**

GCGCD questioned why no wells were placed immediately above the wells that were pumped during the two aquifer tests,<sup>146</sup> as placing wells immediately above the pumped well would test the integrity of the well construction, and would test the effectiveness of the confining layer between the production zone at the first overlying sand.

#### **Response 118**

Although none of the observation wells for the two pump tests were located directly above either of the two wells used in the respective tests, observation wells were reasonably close to the pumping wells. For the PTW-1 test, observation wells OMW-1 and OMW-2 were 160 and 280 feet, respectively, from the pumped PTW well, and for the PTW-6 test, observation well OMW-9 was 120 feet from the pumped PTW well. As stated in TCEQ UIC Guidance Document II (Hydrologic Testing), a minimum of 8 observation wells is recommended; UEC has 9 observation wells.

#### **Comment 119**

GCGCD commented that the aquifer tests conducted by UEC were too short in duration to assess the degree of hydraulic connection between Sand B and overlying Sand A.

<sup>145</sup> TCEQ UIC Guideline II-Hydrologic Testing.

<sup>146</sup> Aquifer tests are described in Section 4.0 of UEC's PAA1 application.

GCGCD stated that detailed calculations conducted by Daniel B. Stephens and Associates on behalf of GCGCD indicate that the expected drawdown in Sand A during the aquifer tests would be smaller than could be accurately determined from the observed data even if no clay layer existed between the units. This result, according to GCGCD, is due to the short duration of the aquifer tests, the horizontal distance of Sand A observation wells from the Sand B pumping wells, the vertical distance between the screened intervals of the wells, and the higher storage coefficient of Sand A relative to that of Sand B. GCGCD also stated that given the amount of time Sand B will be mined, the probability of an excursion of mining fluids from Sand B to Sand A is significant.

#### **Response 119**

The two aquifer tests performed by UEC were in accordance with the recommendations in TCEQ guidance.<sup>147</sup> The Executive Director was not provided the source of the calculations mentioned in GCGCD's comments and is unable to specifically address them. In any case, the results of the applicant's aquifer tests, presented in Section 4.0 and Appendix D of the application, indicate no hydraulic connection between Sand B and Sand A within the proposed production area. Geophysical logs of wells drilled within the proposed production area indicate at least 40 feet of clay between the base of Sand A and the top of Sand B, which should provide a sufficient barrier to the migration of mining fluids from Sand B to Sand A.

#### **Comment 120**

GCGCD commented that the results of aquifer test PTW-1 do not indicate a slight increase in the water level in well OMW-1, which is completed in Sand A, as claimed by UEC.<sup>148</sup> According to GCGCD, test data indicate a slight overall decline in the water level in this well.

#### **Response 120**

The Executive Director does not agree with GCGCD's interpretation. Figure 4.10 of UEC's PAA application is a graph of water levels during pump test PTW-1. Based on this graph, water levels in OMW-1 are rising slightly, not declining.

#### **Comment 121**

Blackburn Carter (BC) expressed the concern that the possible effects of the proposed *in situ* mining activity on sediments of the Goliad Formation, and therefore on the sediments of the Chicot and Evangeline aquifers, has not been fully characterized. BC stated that the conclusions presented on the aquifer tests<sup>149</sup> are vague, with little explanation of the results, much less the details required to make a rational judgment about the site-specific stress that will be created by the proposed mining activity. BC recommended that UEC be required to integrate the data gathered with a mathematical hydrologic modeling effort similar to the Daniel B. Stephens work.

#### **Response 121**

<sup>147</sup> TCEQ UIC Technical Guidance Document II—Hydrologic Testing.

<sup>148</sup> UEC PAA1 application, page 4-23 and Figure 4-10.

<sup>149</sup> UEC PAA1 application, Section 4.0.

The Executive Director has reviewed UEC's discussion presented in Section 4.0 of the application and finds it to be adequate to comply with applicable rules. Results of the two hydrologic tests indicate that Sand B is hydraulically connected within the proposed mine area. This hydraulic connection indicates that any excursion of mining fluids from Sand B within the production area will preferentially travel within Sand B, and will be intercepted by the production zone monitor wells, allowing for detection of excursions. The results of these tests also indicate no hydraulic connection between Sand B and overlying Sand A. Regardless, Sand A will be monitored for excursions. The Executive Director acknowledges the utility of numerical modeling, but notes that these pump test results are based on actual measurements of the fluid movement in the proposed production area. Again, these pump test results, coupled with the thickness of the confining layer between Sand A and Sand B, demonstrate that the production zone monitor wells are in hydraulic communication with the production zone of the production area and that the overlying Sand A is not in hydraulic communication with the Sand B production zone.

#### **Comment 122**

Blackburn Carter expressed concern about the effects of faults on the area hydrogeology, and referred to questions asked by the Executive Director in a Notice of Deficiency (NOD)<sup>150</sup> letter to UEC regarding the Class III UIC area permit. BC specifically referenced NOD questions 22 and 23, in which the Executive Director asked if planned hydrologic tests would be designed to evaluate possible effects faults would have on the area hydrogeology. BC also referenced UEC's responses to these questions, in which UEC stated hydrologic tests would address the transmissivity of faults in the area; vertical confinement of the four Goliad Sands cut by the fault; and possible hydrologic communication where the fault juxtaposed Goliad sands with sands of the underlying Lagarto Formation. BC stated they were unable to locate any fault-related testing in this NOD response, they assumed that these two NOD questions remain unresolved, and are being delayed until the pump test results are submitted either with the PAA application, or a late NOD response. BC questioned if these pump tests actually exist.

#### **Response 122**

As discussed in Response 58, UEC identified two faults in the proposed permit area. Also, in response to the Executive Director's notice of deficiency letter regarding UEC's application for a Class III UIC area permit, UEC stated that hydrologic testing would address the transmissivity of faults. The Executive Director notes that neither of these faults is within the area of the proposed Production Area 1. The northwestern fault is 1200 feet to the northwest of the production area and the southeastern fault is about 2000 feet southeast of the proposed production area.<sup>151</sup> Given these distances from the proposed production area, these faults should not affect *in situ* mining in Production Area 1. However, the northwestern fault is within three other possible future production area identified by UEC in their Class III UIC area permit application.<sup>152</sup> If and when UEC submits applications for production area authorizations for any of the other planned

<sup>150</sup> January 7, 2008 Technical Notice of Deficiency letter from TCEQ to UEC.

<sup>151</sup> Figure 1.3, UEC Class III UIC area permit application.

<sup>152</sup> Page 1.1, Figure 1-3.

production areas, those applications will need to include an analysis of the transmissivity of these faults.

## **U. MISCELLANEOUS**

### **Comment 123**

Weldon Scott Orr expressed his full support of the Goliad County Commissioners in their judgment that uranium cannot be mined in a safe manner in Goliad County.

### **Response 123**

The Executive Director acknowledges Mr. Orr's support of the Goliad County Commissioners in this matter.

### **Comment 124**

David and Carol Warren asked if the mining industry can recover uranium from the production zone, why they cannot also recover other constituents that are dissolved into the groundwater during *in situ* mining. The Warrens state that if the industry would develop a market for these other constituents, they would not have to be reinjected in their active, oxidized form.

### **Response 124**

Injection wells have been used to recover other minerals from the subsurface such as sodium sulfate and sulfur. However, UEC has not proposed to recover any minerals other than uranium. The Executive Director's role is to evaluate the application that as it is presented by the applicant under the applicable laws and rules. The Executive Director does not have the authority to require UEC to develop other constituents.

### **Comment 125**

David and Carol Warren asked if there are methods to mine the uranium that are not as toxic to the aquifer.

### **Response 125**

Depending on the grade of the uranium ore, its depth, and general economic considerations such as the price of uranium oxide, uranium could be mined using open pit or underground methods. However, open pit mining is more invasive than *in situ* mining for several reasons. First, the sediments overlying the ore zone (called the overburden), would have to be removed and stockpiled. Second, because the ore occurs within the saturated zone, the area to be mined would have to be continually dewatered to allow extraction of the ore. Third, the sediments that contain the ore would have to be removed and then processed to recover the uranium from them, which would result in the generation of large volumes of waste rock (called tailings). Underground mining would not result the generation of overburden, but would result in the generation of waste rock, and also would require dewatering of the aquifer and the generation of tailings. Compared to these two methods of mining, *in situ* mining will result in no generation of overburden, waste rock, or tailings, and less disposal of groundwater.

**Comment 126**

GCGCD commented that the TCEQ should require UEC to provide clean, electronic copies of the PAA application and all subsequent updates for ease of review and evaluation by interested parties. GCGCD expressed the opinion that this requirement would not be overly burdensome to UEC and would facilitate more effective review and comment of UEC application materials.

**Response 126**

GCGCD is a party to the contested case hearing and can submit a request for production to UEC through the discovery process.

**Comment 127**

At the October 5, 2009 Public Meeting that was held in Goliad, Texas, a package of 41 letters, dated July 7, 2009, was submitted to the TCEQ as formal written comments. The letters were addressed to the GCGCD and Goliad County Public Officials, and were in the format of a petition requesting that local government entities stop expending county tax revenues to fight economic growth and business opportunities. The petition also requested for county officials to stop using tax revenues on legal actions that result in the loss of private property rights and economic development. The petition further stated that private property rights, economic growth, and business opportunities have come to a stop in Goliad County due to lawsuits funded with taxpayer money. The petition also stated that private mineral rights are being damaged by legal actions taken by the Goliad County Commissioners and the GCGCD. Lastly, the petition demanded that local officials work with industry to create jobs and a stronger tax base. The petition contained 227 signatures.

**Response 127**

The Executive Director acknowledges this petition as a comment in support of the proposed PAA.

**Comment 128**

Richard Bettge commented that the PAA should require that pumping reports be available any time at unannounced inspections.

**Response 128**

These reports will be available at the facility for review by TCEQ inspectors, as required by rule.

**Comment 129**

Richard Bettge commented that the PAA should require that all drilling equipment be sanitized so that drilling does not contaminate a monitor well.

**Response 129**

The completion of monitor wells is not addressed in a PAA. As discussed in Response 18, the Executive Director determined that UEC has implemented appropriate well development methods to assure that a well can be used properly for its intended purpose. To ensure that valid samples are collected, provision III.B of the draft PAA requires that sampling be done in accordance with 30 TAC §331.105 (Relating to Monitoring Standards) and in accordance with Provision V.G of the proposed Class III injection well area permit no. UR03075 for all monitor wells and baseline wells.

**Comment 130**

Richard Bettge commented that maximum oxygen levels should be established for the injected mining solutions.

**Response 130**

Establishment of the amount of oxygen used to fortify the mining solution is not established by rule because the amount of oxygen needed to mobilize the uranium may vary depending on the grade of uranium encountered in any particular part of the production area. The operator needs to have control of the oxygen content of the mining solutions to recover the uranium efficiently.

**Comment 131**

Raymond and Karon Arnold asked whether TCEQ has a plan to water livestock in the event water levels decrease that wells are dry. The Arnolds also asked if allowing livestock to die was acceptable to the TCEQ, and if the TCEQ is prepared to accept responsibility for cruelty to animals in the event livestock die of thirst because water wells run dry.

**Response 131**

Based on the projected water use at this site (Section 7.0, Table 7.2 of the application) of about 1,169 acre-feet over a period of about eight years, the TCEQ does not anticipate groundwater levels will decrease to the extent that local wells will go dry (UEC's November 6, 2009 amendment to the application reflects a revised estimate of projected water consumption from 2,417 acre-feet to 1,169 acre-feet). The TCEQ has no plans for providing water for livestock in the event local water wells run dry.

**Comment 132**

Roland Burrows asked if the facility workers will receive training regarding well field operations, particularly with regard to maintaining a proper balance of injected fluids.

**Response 132**

Under a radioactive materials license, an operator is required to provide training regarding radiation safety, but not regarding well field operations. The TCEQ rules do not require the permittee to provide specific training on well field operations to its employees. UEC is required to comply with all rules and conditions of its permit and PAA and should ensure that its employees are sufficiently trained to comply with all requirements.

**Comment 133**

Roland Burrows asked if UEC will provide for audit by qualified county employees reports regarding maintaining balanced injection and production rates.

**Response 133**

Regulation of *in situ* uranium mining is under the jurisdiction of the TCEQ, not county government. The Executive Director is not aware of any plans for UEC to allow monitoring of injection and production rates by Goliad County employees.

**Comment 134**

Ted Long commented that UEC should inform the citizens of Goliad County as to the company's overall plan for uranium mining in the county, including acreage leased, exploration activities, and potential mine sites. Mr. Long stated that if many mine sites are authorized, the quality and quantity of water will be lowered over large areas of the county as these areas are declared exempt aquifers.

**Response 134**

The TCEQ does not have the authority to require a company to provide this information to the public. Exploration permits are issued by the Texas Railroad Commission, and information on current permits are available on their website at <http://www.rrc.state.tx.us/licenses/smr/uraniumexploration.php>. UEC did provide information regarding potential future production areas within the proposed Class III injection well permit area.<sup>153</sup>

All *in situ* mining must be done in accordance with applicable statutory and regulatory requirements, which are designed to protect the state's groundwater. All aquifer exemption requests must meet the requirements of 30 TAC §331.13, and are subject to public notice, opportunity for public comment, and opportunity to request a contested case hearing.

**Comment 135**

Ted Long asked what types of vehicular traffic on county roads the county might expect from the UEC site, and asked if hazardous materials from the site will be transported over public roadways in Goliad County. Mr. Long also asked who will be responsible for damages to county roads from excessively heavy truck traffic.

**Response 135**

The effects of traffic from the proposed facility are addressed in a Radioactive Materials License. UEC has submitted an application for such a license, and the application currently is under technical review. The applicable rules for a PAA do not address any traffic or roadway usage requirements. The TCEQ does not assess damages for harm to county roads or property.

**Comment 136**

<sup>153</sup> Section 1.0 UEC Class III injection well permit application



Ted Long asked if UEC has a contingency plan for natural disasters or power outages. Specifically, he asked what provisions are in place to protect groundwater and air quality during natural disasters such as hurricanes, freezes, wildfires, drought, or excessive rainfall events.

**Response 136**

The requirements in 30 TAC Chapter 331 that apply to production area authorizations contain no specific requirements for such contingency plans for natural disasters. The application for the radioactive materials license, which currently is under review, addresses certain aspects of emergency response.

**Comment 137**

Ted Long asked who will monitor the construction of these fields to guarantee that no short cuts are taken and the required materials are properly installed.

**Response 137**

Well design was discussed in Section 9.7 of UEC's Class III UIC area permit application. All Class III wells must meet the construction requirements found in 30 TAC §331.82. Construction and completion of all Class III wells must be approved by the Executive Director.<sup>154</sup>

**Comment 138**

Ted Long asked what landowners can expect from UEC for damages due to increased noise levels associated with the proposed facility.

**Response 138**

The TCEQ does not assess damages for civil liability claims such as nuisance.

**Comment 139**

Wayne and Margie Smith expressed their full support of the Goliad County Commissioner's court and the Goliad County Groundwater Conservation District.

**Response 139**

The Executive Director acknowledges the Smith's support for these entities.

**Comment 140**

Tom Stockton, representing South Texans for Clean Energy expressed the opinion that *in situ* uranium mining can be done in a safe manner, and was in favor of issuance of any permits needed for UEC to conduct *in situ* mining operations at this site.

**Response 140**

The Executive Director acknowledges Mr. Stockton's support.

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<sup>154</sup> 30 TAC §331.45(3).

## V. Changes Made in Response to Comment

In response to comment, the Executive Director has revised the baseline table and restoration table of the draft PAA.

Respectfully submitted,

Texas Commission on Environmental  
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